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INDUSTRIAL REGULATION.

The electrical industry, as much, or perhaps more, than any other large industry, is in an early stage of development, a condition which is usually accompanied by considerable business activity, and steady and regular demand for supplies. In spite of this fact it cannot be denied that in most of its branches it has been subject to the same depression which has been affecting the general business situation for the past year or two. At the present there is little indication of any reaction from this condition. In some quarters the general business situation has been attributed to the Government's activity in enforcing the anti-trust laws. While this may have contributed somewhat to the existing uneasiness, it is probable that its effect has been over rated. In the two cases that were carried to the Supreme Court the results were not at all disastrous to the defendants and have in no way impaired trade in those particular channels. As for the prosecution which has started about a year ago against the "electric trust," a very amicable settlement was reached by the attorneys for the Government and for the companies affected, and neither the situation in the electrical industry nor the volume of trade can be said to have been at all affected by this proceeding.

It is certainly desirable, nevertheless, that the Government should arrive at some definite policy regarding its attitude toward and treatment of the large business and industrial corporations of the country. In the case of the railroads and other common carriers the Government policy of regulation has been settled, with the result that many of the abuses which were connected with this industry have been, or are being, stopped. While the public-service corporation, owing to the natural monopoly of its business and the nature of the public interest in its operation, may be regarded as coming peculiarly under the necessity for regulation, it has been, perhaps, not only on account of its nature but largely on account of the conditions existing, that it was brought into the position of accountability to government authority. Even before the regulation of railroad corporations was undertaken by the Government, a similar oversight and control was adopted in the case of the banking business, so far as this could be brought under federal authority by the incorporation of national banks. This action was taken, not so much because banking is a public function, as because the

general good of the people, especially insofar as interstate commerce was concerned, necessitated it.

It seems advisable that the Federal Government should exercise a similar control over large industrial corporations of all kinds through the medium of federal incorporation and inspection, with complete publicity of the business of such corporations. The present attempt to control big business is based upon the idea that competition is the proper basis of relation in the industrial world. This is entirely opposed to the point of view which has been adopted with regard to the railroads, where competition in the form of rate-cutting and rebates, with their accompanying dishonest practices, has been eliminated. The natural tendency of the present generation is toward co-operation rather than competition, and a policy which depends upon the latter seems to be a grievous mistake. The Government's efforts toward relief from the oppression of large industrial combinations should take the form of regulation with the idea of co-operation as the ultimate goal, rather than an attempted forcing of business back into the old lines of competitive methods. Dissolution as a solution of the evils connected with large industrial concerns has been realized to be a delusion.

The large industrial combinations have, through the control of natural resources, placed themselves usually in the position of the public-service corporations so far as regards the monopoly element in the control of their respective lines of business. They should, consequently, be treated from the monopoly point of view, and dealt with by the same methods which have proved effective in the case of those industries which constitute natural monopolies. It may be that under certain social conditions the competitive relation of men might be the most desirable one, but certainly not under present conditions. The greatest monopoly of all is the monopoly of land, and until this is effectively broken or regulated, competitive methods in large industrial combinations cannot be expected to give ideal results.

ELECTRICAL-CONVENTION PRELIMINARIES.

It is not intended in these remarks to undertake to formulate any specific plan of arrangements for electrical conventions. Many of the conventions of this sort are well planned and result in great good to the electrical industry. There is, however, one particular matter in this connection, the importance of which, it seems, is sometimes very unfortunately overlooked; and that is the provision for bringing out the fullest possible discussion of the topics which come before a meeting of the kind in question.

There are able, practical men in the electrical field who attend annual conventions of local electrical associations regularly, but who could not be prevailed upon to undertake the preparation of a paper to be read there. Men of this type, though, if they are given the proper opportunity, can often contribute much valuable discussion to papers prepared and read by others. But this discussion cannot usually be expected to amount to very much unless the papers have been read before hand by those who might take part in it; and this means, as a rule, that the papers must be printed and copies of them distributed before their final presentation. Some of the state electrical conventions recently held have been particularly strong in every way except in the discussion of papers, and in this one respect they have sometimes been deplorably weak. Printing and distributing the papers as just suggested would, in most cases, do much toward removing this condition. The cost of the printing would generally be a splendid investment.

The results evidenced in such national organizations as the American Institute of Electrical Engineers, the National Electric Light Association and the American Electrochemical Society are sufficient argument on this point, and the difference in results where these organizations fail to have the papers distributed in advance is very noticeable.

QUICK ACTION IN EMERGENCY SERVICE.

A recent fire in an apartment house in Chicago illustrated the speed with which the public-service companies of that city render efficient assistance to their customers in an emergency. A hot basement fire, caused by the ignition of waste material in the furnace room, caused considerable damage to one apartment on the lower floor, destroying the electric light, gas and telephone connections. Pending the adjustment of the fire loss with the insurance interests, the parties burned out arranged to move into an adjoining apartment, formerly unoccupied. One clear understanding over the telephone from a downtown office, set in motion the machinery of the public-service companies. The fire occurred on Thursday evening. The following afternoon the Chicago Telephone Company had restored service in the burned out apartments and had installed emergency service in the new apartment. The gas connections to ten meters had been burned off, but by Sunday afternoon new meters had been installed and the building equipped by the Peoples Gas Light & Coke Company. Simultaneously the Commonwealth Edison Company had made new connections, arranging for temporary meter service in the new apartment and maintaining a service in the burned apartment until all moving had been conveniently accomplished. Conversely every item in connection with the fire coming under private control of the owners or agents of the building has been bungled and delayed in adjustment. On the part of the tenants there has been in this instance a fine appreciation of the efficiency of the trained organization in contrast with the slipshod and indifferent characteristics of the individual.

SIDE LIGHTS ON COMMERCIAL ILLUMINATION.

The progress of illuminating engineering clearly indicates that new points of view must be taken by central stations expecting to develop an expanding service in the fascinating field of commercial electric lighting. One has only to compare the latest and best work with that which passed criticism two or three years ago in order to appreciate this. It would be difficult to cite any branch of central-station work which offers larger opportunities for improvement than lighting practice, despite the fact that more attention has been given to illuminating problems than to any other issues, taking the life of the industry as a whole. The state of flux in which the industry now finds itself is in large part due to the progressive development of more efficient lamp filaments and to the manufacture of highly specialized and diversified types of shades and reflectors, coupled with the growing appreciation by the public of the esthetic and practical possibilities of carefully planned installations.

The selection of lamps and reflectors for a given service is a distinct problem for the lighting specialist, and it must be so treated if the consumer is to be given the best results. In too many past instances the aim appears to have been to sell the customer almost anything in the way of equipment to which he takes a fancy, without realizing that high-class illumination cannot be marketed over the counter. The trouble has been that not enough pains have been taken to determine the best equipment in specific cases, and again, that inadequate means have been at hand to demonstrate to the customer the relative merits of different lighting schemes. It almost goes without saying that the consumer is the final judge of what shall be installed on his premises, but even so, more care should be taken to give him a practical demonstration of what the best equipment will do. In other words, there is room for more empirical work in selling light, and the temporary installation or duplicated units set up on the premises of the central station offer much to the discriminating judge. The day is coming when important and costly installations of electric lighting equipment will be made according to the recommendations of men and perhaps women having more than a superficial knowledge of architecture, interior furnishing and decoration, physiological and psychological conditions relating to illumination and not hurriedly rushed into service without any genuinely scientific study of the case in hand. At present white light seems to be the objective of many central stations supplying service to desk and table workers, but in the broader practice of the near future we shall see more emphasis laid upon the value of yellow-tinted lamps in reducing eye strain and less upon the filament efficiency in watts per candlepower. The consumer takes all these improvements in electrical apparatus as a matter of course. His temperature never rises a fraction of a degree over the announcement of a notable gain in the efficiency in a lamp filament, and far-sighted central-station men and illuminating engineers are beginning to realize that cost of operation is bound in time to become a subordinate issue to the consumer capable of appreciating what really first-class service will do for him.

This question of cost is very interesting. Visitors to the city of Denver not infrequently hold up their hands in surprise at the amount of window and sign lighting which the local company has persuaded the merchants to buy. Even the little drug stores in the residential sections use electric lighting to an extent which would do credit to establishments of larger size on Broadway, New York. The amount of window lighting frequently demands energy to the extent of from 150 to 200 watts per square foot, and yet the tendency is constantly toward more display installations. The investment is a good one, particularly in view of the large tourist population of the city and a climate which favors walking at night in the down-town districts pretty much the year through. Actual counts have shown that nearly twice as many persons select the brighter side of the street during an evening stroll as are willing to walk on the darker side. The point for the central-station solicitor is plainly that his task is to favor and push installations which by their tasteful originality and adequacy will draw the public into the establishment and increase trade. If this can be done cost becomes as secondary a matter as the investment item becomes in installing an individual motor drive which will increase production far more than enough to offset all the added expenses of a change in motive power.

The best work in the field of electric lighting is being done with the aid of the laboratory method, and less and less is being left to chance. Witness a twelve months' study of every aspect of industrial lighting as applied in trial installations in the great Curtis publishing house in Philadelphia, the final selection of equipment being based upon a profound scientific investigation combined with due attention to the claims of personal comfort and satisfaction. The amount of research work necessary to develop a diffusing lamp capable of being used in the large textile mills in color matching can only be guessed, but this result and the success attained with the use of alabaster globes and dull-finished reflectors in many commercial installations, points to an amount of practical investigation which bodes well for the future of the art. It is being realized more and more that the success of many installations depends upon such matters as a difference of a few inches in fixture location, upon the type of holder used, treatment of shadows and avoidance of glare, facilities for cleaning shades, ceiling and wall colors, concealment of light sources and selection of concentrating or distributing reflectors. The laboratory method of attack also offers unparalleled opportunities for educational work with the public, as in the comparison of poor and good window lighting by adjustable and portable installations. A new outlook is ahead of the industry, and the central station which responds to the vision of more beautiful and appropriate lighting need not fear the effect upon its revenues.

Indiana Independent Telephone Men Meet.

The seventh annual convention of the Indiana Independent Telephone Association was held in the Claypool Hotel, Indianapolis, May 15 and 16. The meeting was called to order by the president, N. G. Hunter. The address of welcome was made by Mayor Shank and the response made by President Hunter.

The convention was well attended, and while the deliberations were largely centered on the merger question, they were animated and interested. The old officers, N. G. Hunter, president, and Walter Uhl, secretary, were re-elected.

Annual Meeting, American Institute of Electrical Engineers.

The annual meeting of the American Institute of Electrical Engineers was held on the evening of May 21 in the Engineering Societies Building, New York City. The Board of Directors presented its annual report for the fiscal year ended April 30, 1912. In this was embodied a statement of the financial status of the Institute and a summary of the work accomplished by the numerous standing and special committees.

The Committee of Tellers on the election of officers for the ensuing year reported the following as the list receiving the highest number of votes:

President: Ralph D. Mershon, of New York, N. Y.

Vice-presidents: William S. Murray, New Haven, Conn.; Arthur W. Berresford, Milwaukee, Wis.; S. D. Sprong, Brooklyn, N. Y.

Managers: Comfort A. Adams, Cambridge, Mass.; William B. Jackson, Chicago, Ill.; William McClellan, New York, N. Y.; J. Franklin Stevens, Philadelphia, Pa.

Treasurer: George A. Hamilton, Elizabeth, N. J.

Secretary: F. L. Hutchinson, New York, N. Y.

These gentlemen were therefore declared elected new officers for the year beginning August 1, 1912.

Both the amendments to the constitution which had been voted on by letter ballot were declared carried, that relative to the appointment of the secretary receiving a vote of 3,034 in favor and 280 against it, and the amendment establishing an additional grade of membership receiving 2,800 in its favor and 572 opposed to it.

In a brief but eloquent address President Gano Dunn presented a bronze bust of Joseph Henry to the Associazione Elettrotecnica Italiana, which is the Italian society corresponding to the American Institute of Electrical Engineers. The presentation was made as an expression of the many courtesies and hospitalities received by the president and members of the American Institute at the International Electrical Congress held in Turin last September. Philip Torchio accepted the bust on behalf of the Italian society.

A paper by John C. Barclay on "Henry as the Inventor of the Telegraph" was read by title. The meeting was closed by an extended address on "Henry as a Scientist" that was delivered by Dr. Michael I. Pupin.

New York Electrical Society.

A large audience listened with interest to the lucid and exhaustive lecture of Charles P. Steinmetz on "Wave Motion," before the New York Electrical Society on May 15. In Dr. Steinmetz's treatment of this subject, the electrical phenomena in the space surrounding a conductor, through which energy flows, are discussed as a steady stress, or an alternating stress, which moves through space with a finite velocity, and thus is a wave motion. The various forms of such electro-magnetic wave motions, their production and their characteristics, are then discussed, from the low frequency waves of thousands of miles wave length of the alternating-current transmission lines, to the wireless telegraph waves of a few thousand feet length, up to the extremely short high frequency waves, which we know as light, radiant heat, etc.

Among those who joined in the discussion were Prof. W. S. Franklin, Albert F. Ganz and Percy H. Thomas.

To Study Regulation Abroad.

Following a meeting of the Executive Council of the Department on Regulation of Interstate and Municipal Utilities of the National Civic Federation, it was announced that R. H. Whitten, librarian-statistician of the New York Public Service Commission for the First District, had been secured for approximately four months' special investigation work into the matter of public-service corporations in England. Mr. Whitten sailed recently from Boston and will proceed direct to London on his arrival at Liverpool. In his investigation particular emphasis will be given to the questions of profit-sharing, the sliding scale and control of capitalization.

The contemplated investigation in England is a part of the general scheme of the investigation that is being made by this department of the Civic Federation into the question of what constitutes adequate regulation of public utilities. The present investigation is the logical result of a former one which inquired into the merits of public ownership and operation.

Newark Industrial Exposition.

The Newark Industrial Exposition which opened last week at the First Regiment Armory under the auspices of the Newark Board of Trade has proved a great attraction to the citizens of that industrial center. There are 190 exhibitors, all Newark enterprises, and the combined value of the exhibits totals over $1,000,000.

The principal exhibits show machinery in motion making the necessities and luxuries of life. This machinery is all run by electric power furnished by the Public Service Electric Company. Among the exhibitors are the following electrical companies: the General Electric Company, Westinghouse Electric & Manufacturing Company, Crocker-Wheeler Company, Sprague Electric Works, Public Service Electric Company, Lansden Company, Atlantic Vehicle Company, Bell Electric Motor Company, Newark Electrical Supply Company, Driver-Harris Company, Beaver Engineering Company and Scott Electrical Company.

Electrical Supply Jobbers Open Meeting at Atlantic City.

The May meeting of the Electrical Supply Jobbers' Association was opened at the Hotel Chalfonte, Atlantic City, N. J., with the meeting of the Atlantic Division at 10 o'clock Wednesday morning. There was a big representation of prominent jobbers and manufacturers present. Among the early arrivals were A. D. Page, E. W. Rockafellow, W. B. Kinkead, N. C. Cotabish, H. C. Rice, W. S. Bissell, F. V. Burton, J. H. McGill, T. S. Ringgold, W. W. Low, Arnold Friend, G. C. Richards, F. P. Vose, L. W. Kittman, J. B. Olson, Edward R. Grier, C. N. Trump, E. A. Jenkins, P. S. Bover, H. B. Kirkland, B. Downs, C. E. Corrigan, F. S. Price, P. S. Dood, G. F. Patterson, George S. Searing, McKew Parr, W. S. Sisson, S. B. Condit, Jr., F. D. Masterson, H. W. Bliven, B. E. Salisbury, Franklin Overbagh, S. O. Phillips, C. W. Ridinger, Robert Kaiser, E. M. Scribner, A. C. Garrison, S. W. Hagens, G. M. Stuart. Meetings were held on Thursday and Friday. One of the leading features was an address by Frederic P. Vose, on "Electrical Credits."

McKinley Syndicate Acquires New Property.

Negotiations have been completed whereby the McKinley Syndicate, operating numerous public utilities in Illinois, purchased the gas and electric plant of the Carlinville (Ill.) Utilities Company. The sale includes all the property with a 50-year franchise.

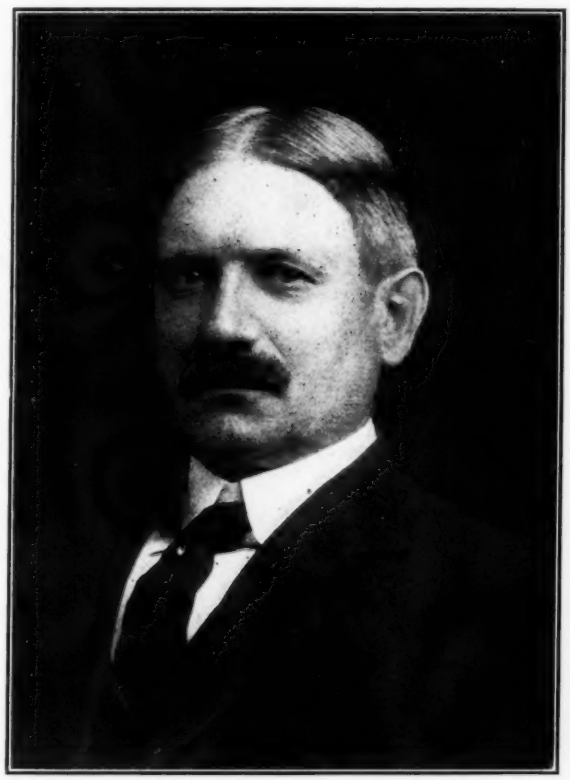
John C. Hatzel.

It is with peculiar interest and satisfaction that we review the career of one so eminently successful as the subject of this sketch, John C. Hatzel. For Mr. Hatzel has achieved success not only in his business, but he is a man of mark among his fellowmen. Endowed with great energy and trained in a school of wide experience, he has coupled his native ability with a disposition so genial and friendly that he has made strong admirers wherever he has been located.

John C. Hatzel was born in New York City and educated in the public schools and the College of the City of New York. He followed this with a course in the New York Nautical School, and for several years was an officer in the American merchant marine. He entered the employ of the Edison Electric Company early in 1881. He was in the construction department until 1885, serving as superintendent of construction for the southern district. In the fall of 1885 he engaged in electrical engineering and contracting, installing central stations and isolated plants and electric railways in various parts of the country.

He became president of the Western Edison Company in 1888, representing the Edison interests in Colorado, Utah and New Mexico. Mr. Hatzel returned east and formed a partnership with Joseph Buehler in the fall of 1889, conducting an electrical engineering and contracting business. This partnership continued until February, 1911, when Mr. Buehler retired. The business was continued by Mr. Hatzel under the old firm name.

Mr. Hatzel is a member and for five years was president of the New York Electrical Contractors' Association. He is a life member and vice-president of the New York Electrical Society, third vice-president of the National Electrical Contractors' Association, associate member of the American Institute of Electrical Engineers, a member of the Illuminating Engineering Society, of the Electrochemical Society, and a member and a governor of the New York Building Trades Employers' Association, a member and past president of the Alumni Association of the New York Nautical School, a member of the Engineers' Club, the Newport Yacht Club, the Harlem Republican Club, and he is also a member of Masonic and other fraternal orders.



John C. Hatzel,
Vice-President, New York Electrical Society.

Waterpower Development in Kentucky.

Well-informed electrical men assert that it will be a matter of only a short time before Kentucky, Northern Ohio and West Virginia cities are served by power produced at the stations of the Tennessee Power Company on Ocoee River and Caney Fork. With the 80,000 horsepower which will be produced at the former and 25,000 horsepower at Rock Island, on Caney Fork, the Tennessee company will be able to transmit an enormous volume of energy into Kentucky, and connection with Lexington and Louisville is looked for as a matter of course, while Cincinnati will also be reached later. The development of water power on Dix River and at Cumberland Falls, in Kentucky, is regarded as projects which will be part of the general scheme. The Cumberland Falls plant, if built, will be erected by H. M. Byllesby & Company, which controls the Tennessee Power Company, while the Dix River Power Company, though no formal announcement has been made, is also backed by interests which are allied with those of the Byllesby and associated companies. The linking up of these various water plants is regarded as desirable from an operating standpoint, since the chances favor there being a sufficient supply of water at one point to produce a maximum amount of energy at a time when one or more of the other stations would not be able to get a maximum output on account of lack of water. On the other hand, by keeping the steam plants of the local stations in the various consuming centers in reserve, the water power companies can provide against the contingency of not being able to supply energy on its contracts, and can secure current from the central stations for distribution over its system. Definite arrangements along the lines indicated will probably be announced shortly.

Election of Officers of the National Fire Protection Association.

At the closing session of the sixteenth annual convention of the National Fire Protection Association in Chicago, on May 16, the following officers were elected: President, H. L. Phillips, of Hartford, Conn.; Vice-President, G. M. Robinson, of San Francisco; Secretary and Treasurer, Franklin H. Wentworth, of Boston; Executive Committee, F. J. T. Stewart, of New York, E. B. Hatch, of Chicago, E. P. Heaton, of Toronto, R. L. Humphrey, of Philadelphia, C. H. Phenney, of Boston, and F. B. Sellars, of Columbus.

At this closing session there were presented handsome silver services to W. H. Merrill, of Chicago, the retiring president of the Association, and to C. M. Goddard, of Boston, now a member of the Electrical Committee, and formerly the secretary of the Underwriters' National Electric Association.

The presentation on behalf of the Association to its retiring president was made by Mr. Goddard, who spoke appropriately of Mr. Merrill's great service to the Association, and of his efficient management of the Underwriters' Laboratories.

The testimonial to Mr. Goddard was presented by F. E. Cabot, of Boston.

Bell Company Opens Exchange in Hannibal, Mo.

On May 10 there was held the formal opening of the Bell telephone exchange in Hannibal, Mo. A feature of the occasion was the musical program, selections being transmitted by wire to the exchange.

Meeting of the Commonwealth Edison Section N. E. L. A.

The third meeting of the Technical Division, Commonwealth Edison Section of the N. E. L. A., was held at the rooms of the Western Society of Engineers on May 15. Over 100 members of the Section were present, to hear papers presented by P. B. Juhnke and C. A. Keller on the general subject of "High-Tension Transmission and Distribution."

Mr. Keller stated in opening his remarks that the solution of the conservation problem would in a large measure depend on successful transmission of electrical energy over a long distance. The modern engineer even forsees the common usage of voltages up to 200,000 for the transmission of energy to coal fields distant from the place of power generation.

The Frankfort-Laufen line which was the first really successful high-tension line was briefly described. This line operated at 13,000 volts, transmitting 300 horsepower over 108 miles. Later the voltage was raised. At Telluride, Colo., the first hydroelectric long-distance transmission line was built. This line commenced at 6,000 volts, but later the voltage was raised to 10,000. Later Niagara followed, with its 11,000-volt line.

Since the first successful transmission at high tension, the rate of increase has been about 6,000 volts per annum, which would, if the rate were continued, soon warrant the use of 200,000 volts.

Underground lines, the speaker said, are making great progress in England, but we seem to be a little behind in that respect. The Germans, who are perhaps the leaders in high-tension underground transmission, are laying armored cables directly underground, with great success.

High-tension direct-current transmission has had but little success, although one line, the Montreuil-Lyons line in France, transmits 4,000 kilowatts, 112 miles at 57,000 volts. A constant current of 55 amperes is carried, all machinery being connected in series, and being self regulating. A 750-mile line was proposed to transmit high-tension direct current from the Victoria Falls in Africa to the Rand gold fields, but this never became practicable.

An interesting point taken up by Mr. Keller was the effect of corona loss in protecting the line against surges. At very high voltages the energy is partly dissipated by the corona effect, and lines, apparatus, etc., are protected. Nickel-plated line wire has also been suggested as a remedy for surges resulting from breakdowns.

Mr. Keller showed numerous lantern slides of curves, high-tension towers and apparatus of various kinds.

The paper read by Mr. Juhnke took up the question of transmission from an economic standpoint. The investment of a large company in power lines may run well into the millions, and for that reason a saving of even a small percentage would be considerable. In a representative case of a large company where the load-factor of the generating machinery is 33 per cent, the load-factor of the lines is in the neighborhood of 18 per cent, which shows considerable room for improvement.

A considerable saving in investment on lines might be brought about if a system was devised with care as to reserve lines connecting substations. Instead of having a reserve line for each substation one line might do for two, three or even five. Several stereopticon slides were used to illustrate the proposed methods of connection.

Mr. Juhnke also stated that problems, such as regulation and reliability, must be satisfactorily solved before alternating current will everywhere take the place of direct current, even considering the transmission difficulties of the latter.

H. B. Gear, in discussing the papers, spoke especially of corona loss, and the charging current necessary on long lines. In one case he mentioned, a 105-mile line operating at 40,000 volts, it was necessary to run two 1,000-kilowatt generators merely to charge the line. He also commented on the tendency to use underground high-tension lines. One city is installing a 6,000-volt underground system, and in consequence is finding that it has a good many difficulties to surmount and numerous problems to solve. Extensive figures on this work do not seem to be available.

In any alternating-current installation the difficulty is to get satisfactory lighting and power service from the same set of mains; and the ability to do this with direct current is the one thing that justified its use. There may at some time be a three-phase motor with low starting current, and such a piece of machinery would doubtless make alternating-current systems universal.

W. L. Abbott joining in the discussion gave an interesting comparison of the cost of coal as compared to the cost of transmitting power over very long distances. R. F. Schuchardt spoke briefly of the possibility of long transmission lines in the form of bus bars laid at ground level.

Pittsburgh Jovian Meeting.

William H. Davis, postmaster of Pittsburgh, addressed the Jovian Electrical League of Pittsburgh at one of its recent meetings in the Fort Pitt Hotel. He spoke on "Co-Operation from the Standpoint of the United States Government." Mr. Davis, who is regarded as one of the most progressive postmasters in the country, stated that the Government is now doing a vast quantity of work which should rightly be performed by the people themselves.

The Electric Passenger Vehicle.

At the regular monthly meeting of the Electric Vehicle Association of America, held in the Engineering Societies Building, New York, May 21, George H. Jones and R. Macrae, of the Commonwealth Edison Company, Chicago, presented a paper on the "Electric Passenger Vehicle."

It was pointed out that the transportation question is no longer one between automobiles and horse-drawn vehicles but rather one of choice between the various types of automobiles to determine the one best fitted for the purpose at hand.

The field for the electric pleasure car is referred to and attention called to the desirability of this business from the central-station standpoint. It was stated, however, that the principal difficulty of carrying on a campaign arises from the fact that the central stations themselves do not know any too much on the subject and are often at a loss as to what kind of instructions to give. They are consulted with regard to different kinds of vehicles and different kinds of batteries. Scarcely anything can be obtained from the catalogues of the different vehicle manufacturers to enable them to know what advice to offer. The greater number of electric vehicle catalogues make no reference to methods of operating and of taking care of the vehicles or of the amount of power required to operate them, and the purchaser of a vehicle is generally allowed to get information on these subjects as best he can.

While for commercial reasons it probably is not desirable to include in catalogs a mass of operating details, yet there is absolutely no question but that the vehicle manufacturers should furnish comprehensive instruction books for the guidance of owners. The paper states that these books should go fully into details in regard to the construction of the car in order to facilitate the making of repairs, and, furthermore, they should contain explicit directions for taking care of batteries and for charging them from both direct-current and alternating-current circuits.

In addition to these more specific instructions, the Electric Vehicle Association should adopt some general rules which the central stations need not hesitate to give out for fear of offending some particular manufacturer, or of unduly advertising some special apparatus. As the batteries constitute the vital part of an electric vehicle, such instructions would necessarily deal principally with the charging and care of batteries. The paper concludes with a reprint of the battery instructions issued by the Commonwealth Edison Company, and electrical data on Edison batteries.

Electric Refrigeration in the Ice-Cream Business

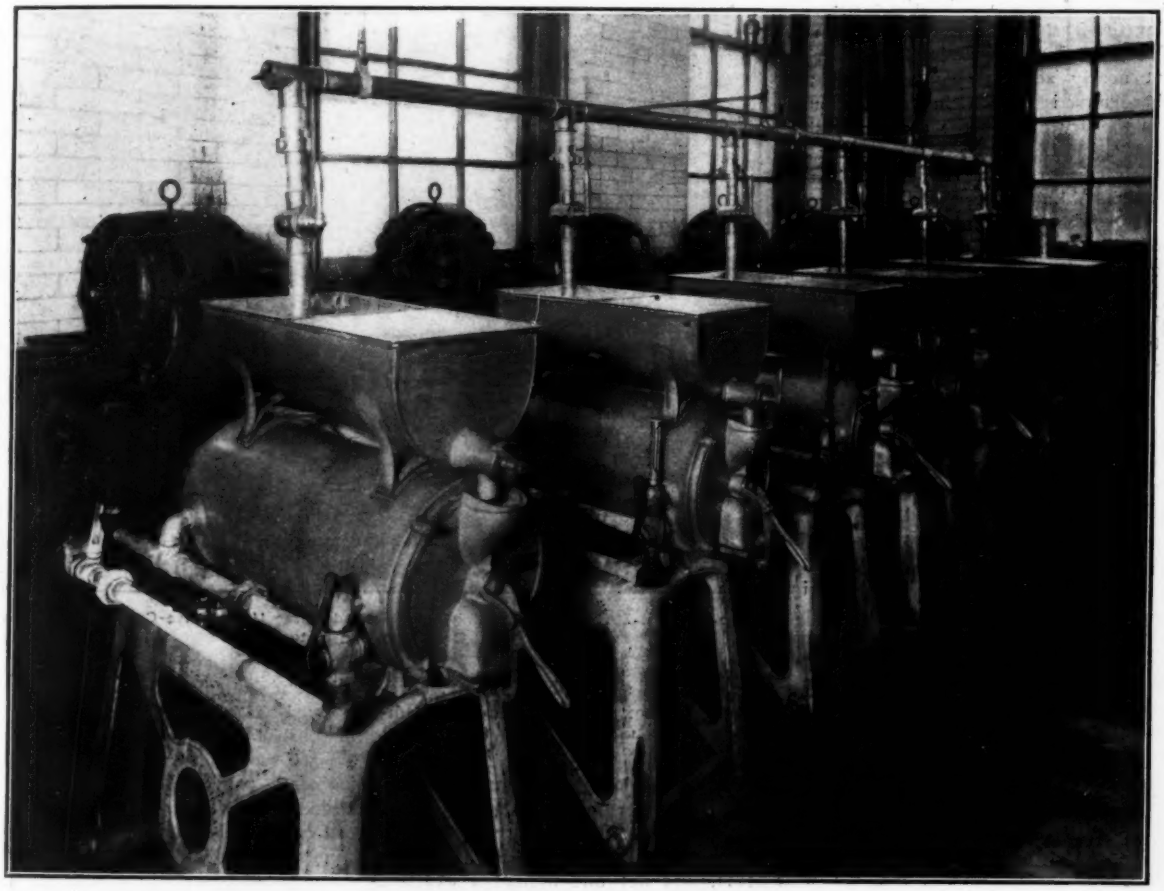
Motor-driven refrigerating machines for the ice-cream maker have, like the consumption of ice cream itself, shown a remarkable increase in recent years. This article compares motor-driven refrigeration with the wasteful methods heretofore used by ice-cream manufacturers, and gives power data on a number of installations.

That great American dish, ice cream, has each year a constantly increasing consumption. The capacity of "Young America" for this frozen product seems practically unlimited. Statistics show that during five years from 1906 to 1910 the estimated production of ice cream in the United States advanced from 55 million gallons to 100 million gallons. In 1911 about 120 million gallons of ice cream were eaten by Americans, making an average of five quarts for each man, woman and child in the whole country.

Under the former method of freezing with a mixture of salt and ice, there were required 1.5 tons of ice and 800 pounds of salt for each 100 gallons of ice cream. This enormous total represents largely waste, for the salt is not recovered and the ice melts very rapidly. The conservation of these materials is being largely promoted by the introduction of artificial refrigeration and applying the refrigerating machinery directly to the manufacture of ice cream.

Motor-driven refrigerating machines for the ice-cream maker have, like the consumption of ice cream itself, shown a remarkable increase in recent years. "Ice and Refrigeration Blue Book" recorded slightly over 100 equipments for this purpose in 1909, while in 1911, 260 are listed. This list is fairly accurate but is not claimed to be absolutely complete. This showing is remarkable and can be, in some measure, attributed to the activity of central stations in advocating the use of these motor-driven machines and the economies obtained by their adoption. Both wholesale manufacturers and retail dealers are rapidly becoming acquainted with their advantages and it is not beyond the limit of expectation to see double the rate of increase during the next two years.

There are two distinct divisions in the process of making ice cream. The first consists in cooling the several ingredients during the period of mixing. This is generally referred to as "the making." When this is completely accomplished the ice cream is viscous, has a soft consistency such that it will flow and take the shape of its container. It is then set aside to harden and be cooled to about 8 degrees or 10 degrees. Each gallon of ice cream requires in the refrigerating machine a capacity equal to 800 British thermal units for the making and hardening. This heat is not all extracted from the ice cream, but allows for leakage and losses. If the ice cream is then to be kept for several days before being sold, addi-



Battery of Motor-Driven Ice-Cream Freezers.

tional provision must be made. Doctor Hart gives 12 gallons of ice cream per hour per ton of machine capacity as a high average to maintain in continuous operation. Pure ice cream thickens at a temperature of 25 degrees, Fahrenheit. It is firm at 15 degrees and solid at its degrees. At two degrees it is too hard to conveniently handle.

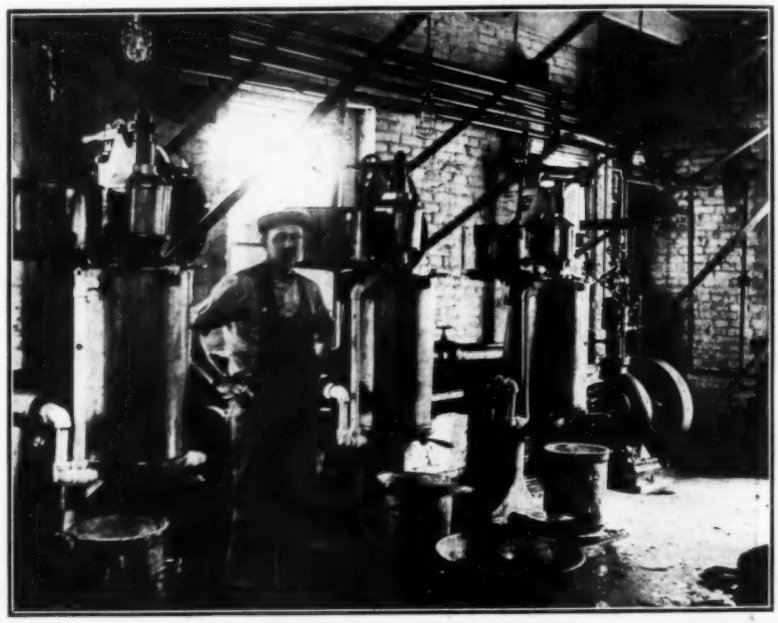
There are two methods in vogue for hardening the ice cream: The dry hardening system, and by the use of a brine tank. In the latter the cooling pipes are immersed in brine contained in what is termed the hardening cabinet. This brine is generally still; that is, not circulated, and maintained at a temperature very close to zero. The cabinet contains usually either a perforated false top or a series of perforated cylinders into which the cans holding the freshly made ice cream are set. They are thus surrounded by cold brine at nearly zero temperature, and the hardening is effected in 6 to 10 hours. In the dry process the cans of freshly made ice cream are set on racks or shelves in a room or refrigerator box in which cold air is circulated by means of fans. Sometimes the racks are formed of the cooling pipes themselves, but usually all the ammonia piping is in a loft or bunker and the air passed and repassed over it until at a very low temperature. As this circulates through and about the cans they are rapidly cooled and the ice cream hardened in from 4 to 8 hours. The latter method is becoming quite general among wholesale dealers, but is not well adapted to the retailer on account of the increased room and expense it would entail in comparatively small installations.

Since the advent of the first brine ice-cream freezer a great many varieties have been put on the market. Many show quite marked improvements. Some are vertical, some horizontal, some on trunnions so as to be tilted. However, all are adaptations of the one principle, namely, of a jacketed can with a revolving paddle. Cold brine flows through the jacket and the ice-cream mixture is cooled in the inner compartment until it is viscous and just capable of flowing out the wide spigot provided to empty it. The mixture is collected in the can which is to hold it while being hardened, and frequently the same can intended for delivery. Ice-cream makers claim there is always a shrinkage in volume when ice cream is repacked, and this handling is avoided to as great an extent as possible.

The introduction of the refrigerating machine into this business has eliminated a vast amount of labor, many unpleasant and unsanitary conditions on account of wet and salted floors, and a great waste of ice and salt. The extravagant use of these two materials was formerly unavoidable, since the low temperature necessary was only obtained by the liquefaction of the mixture, shortly after which it must be discarded.

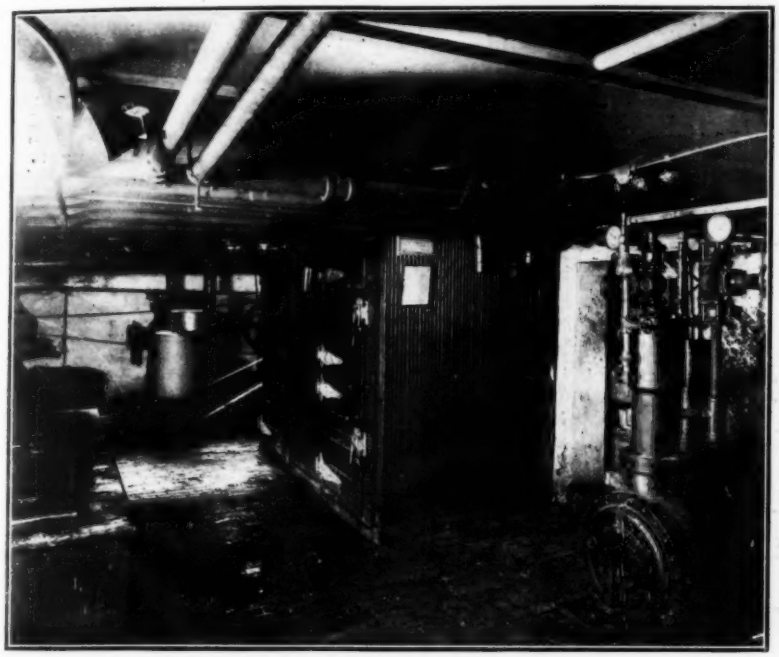
A representative case of a retailer, a "corner bakery," adopting artificial refrigeration is exemplified in the following description of the installation made for Louis Weller.

The plant consists of a four-ton Brunswick ammonia compressor, chain driven by a 7.5-horsepower motor, running at 850 revolutions per minute. A "Clad" vertical 40-quart ice-cream brine freezer, which together with its pump and an ice crusher is driven by a three-horsepower, single-phase motor; a refrigerator box 8.5 by 4 feet (inside dimensions), shown in one of the views; a hardening tank, partially sunk in the floor, holding 14 40-quart cans; a drinking-water cooler and a 14-can serving cabinet in the store. This plant has been in operation since February, 1911, and not one dollar of expense, outside of oil and electric power, has been necessary. Power bills have been for one year $665.62 including the two motors mentioned and a third of two-horsepower capacity used in the cake-baking department. The cost of the refrigerating machine and piping was $1,450. The new boxes and other improvements necessary to the adoption of this system represents an expenditure of nearly as much more, so the total investment amounts to something over $2,800. Fixed charges on this investment at 15 per cent represent a charge of $426.75, making the total expense the first year of $1,092.37. During 1910 ice and salt had cost $1,850 and electric power $150. A saving of nearly $1,000 is therefore experienced in the first year to say nothing of the labor saving and improved prestige in business standing due to the avoidance of unpleasant interruptions to business formerly experienced when re-icing the serving cabinet and cleaning up after it. The details of the installation are interesting, since it may be considered a model plant. The serving cabinet extends along the wall back of the cake counter. It contains 14 40-quart cans immersed to within a few inches of the top, in calcium brine. On both sides of this row of cans are ammonia expansion pipes. The cabinet is insulated with two inches of cork on all sides and bottom, a double thickness of tongued and grooved boards and finished in polished marble. It is lined with galvanized sheet metal and has a top covering of the same material. Each can has an independent cover or lid. At the right end of this cabinet is the drinking-water fountain. The water for it is fed from the city supply through a filter and then passes into a coil contained in a tank cooled by brine. This tank is in the cellar and is also insulated with a two inch cork covering. The hardening tank in this plant projects about 18 inches above the floor. This makes just a convenient height for easily handling the 40-quart cans. Fourteen perforated cylinders are arranged in two rows. These hold the cans in position and prevent tilting or bobbing around if at any time they are not full enough to sink in the brine to the regular level. Between the two rows is a double-pipe brine cooler. The object



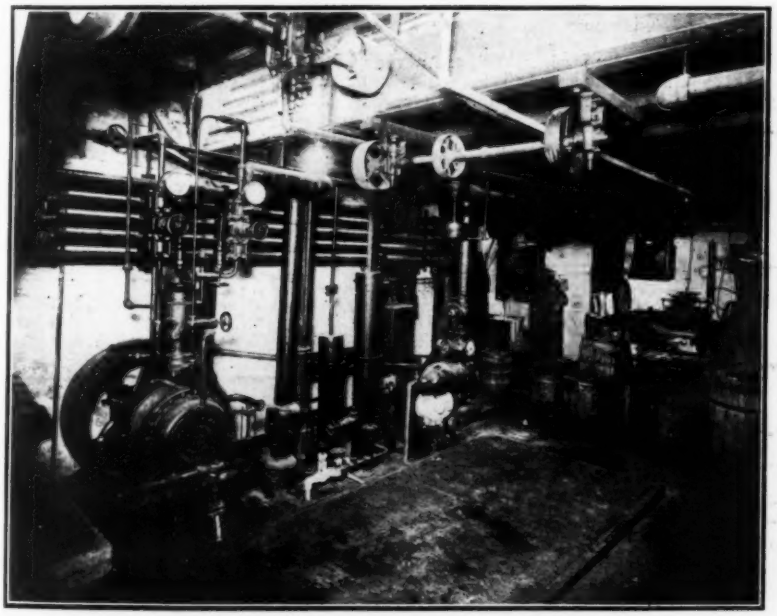
Two-ton Belt-Driven Refrigerating Machine and Three Upright Ice-Cream Freezers, all Driven by One Motor.

of this is to rapidly cool a portion of the brine during the period of making ice crean. Ammonia is contained in the inner pipe and exerting all its cooling value on the brine which is drawn through the outer pipe and circulated immediately about the ice-cream freezer by means of a small rotary pump. It then returns to the hardening tank. Additional ammonia direct-expansion piping is immersed in the brine outside the two rows of cans.



Refrigerating Plant of Louis Weller.

The refrigerator is used to store cream, butter, fruit and other perishable supplies. It also contains direct-expansion pipes and an auxilliary brine tank to hold the low temperature over the non-operating hours of the machine. It is maintained at about 34 degrees, rising from 30 to 38 degrees if the machine does not operate over a period of 15 or 20 hours.



Motor-Driven Refrigerating Machine and Pump.

The brine in the hardening tank is cooled to zero or below and will rise at times to 6 or 8 degrees above. In the warm store, the serving cabinet temperature will rise about ten degrees between 5 p. m. and noon next day.

During seasons when ice cream is not made every day the refrigerating machine will be operated but few hours. Five hours is necessary when making 160 to 280 quarts, while on the intervening days three hours is sufficient. It is usually operated at five pounds back pressure at a speed of 175 revolutions per minute. The head pressure will vary from 80 pounds up to 180 pounds depending on the season and temperature of the condenser water. City water is used for this purpose. The condenser is the double-pipe style consisting of 10 lengths each 12 feet long. All of the exposed expansion and brine piping is insulated with two inches of Nonpareil cork and every precaution has been taken throughout to make the installation as efficient as possible. The results have certainly justified the care and expense.

The kilowatt-hours used month by month are as follows: April, 649; May, 804; June, 1,434; July, 1,829; August, 1,477; September, 1,422; October, 1,023; November, 782; December, 763; January, 646; February, 640; March, 688.

During this period there were made about 25,000 gallons of ice cream, an average of about 280 quarts per day. But there were many days in winter when less than 100 quarts were sold. Averaging for the year gives 472 watt-hours per gallon of ice cream made, hardened and kept until sold. At five cents per kilowatt-hour the cost is 2.36 cents per gallon or one cent for 1.5 quarts for all power for making and refrigerating.

Another installation of motors for operating ice-cream freezers which is of particular interest is in the plant of the J. M. Horton Ice Cream Company. This installation is, however, of rather large proportions, but serves to illustrate the cleanliness, economy and flexibility of electric power.

The present equipment comprises two compressors, one of which is belt connected to a 90-horsepower motor and rated at 50-tons refrigeration; the other being belt connected to a 125-horsepower motor and rated at 75-tons refrigeration. The motors are equipped with commutating poles and are designed for a speed variation ranging from 250 revolutions per minute to 500 revolutions per minute, the change in speed being effected by field control. At the higher speed the compressors deliver full rated output at 65 revolutions per minute. The 50-ton machine has a 14-inch bore and 21-inch stroke and the 75-ton machine a 16-inch bore and 24-inch stroke. As in most commercial plants, ammonia vapor is employed to abstract the heat from the water. Free ammonia gas is first compressed by the refrigerating machine to a pressure of about 150 pounds per square inch. This operation increases the tem-

Refrigeration for Ice-Cream Plants—Data Sheet.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected.

Plant A. Wholesale ice-cream maker. Has an average yearly output of 358,172 gallons of ice cream.
Total connected horsepower, 110. Total number of motors installed, 14. Average kilowatt-hours per month, 9,138.
Kilowatt-hour consumption for 12 months: January, 3,090; February, 3,830; March, 6,000; April, 6,310; May, 13,180; June, 14,600; July, 18,460; August, 15,730; September, 12,010; October, 6,830; November, 4,820; December, 4,800.
Load-factor, 15.2 per cent.
The average electrical energy consumed in this plant is one kilowatt-hour for each 3.2 gallons of ice cream made.

MOTOR INSTALLATION.

The motor installation comprises one 60-horsepower motor with a variable-speed control connected by silent chain to a 30-ton York compressor. Fourteen other motors driving freezers and pumps having a maximum demand of about 85 horsepower are installed.
This plant cools by dry-hardening process in two rooms with circulating fans. It has six 40-quart horizontal brine freezers, each driven by a three-horsepower two-phase induction motor.

Plant B. Average yearly output approximately 30,000 gallons of ice cream.
Total connected horsepower, 10.5. Number of motors installed, 2. Average kilowatt-hours per month, 1,196.
Kilowatt-hour consumption for 12 months: January, 538; February, 543; March, 729; April, 1,011; May, 1,539; June, 1,971; July, 2,067; August, 2,049; September, 1,294; October, 1,066; November, 929; December, 620.
Load-factor, 20.9 per cent.
The total electrical energy consumed per gallon of ice cream made, hardened and kept until sold is 478 watt-hours.

MOTOR INSTALLATION.

The motor installation in this plant comprises:

No.	Horse-power.	Speed R. P. M.	Application.
1	7.5	850	Belted to a four-ton Larsen-Baker refrigerating machine. Direct expansion in serving cabinet and dry-hardening room.
1	3	900	Belted to counter shaft driving horizontal ice-cream freezer and its brine pump.

Plant C. Ice cream and confectionery establishment, the ice-cream plant having an average output of from 300 to 400 quarts daily.
Total connected horsepower, 12. Number of motors installed, 3. Average kilowatt-hours per month, 1,825.
Kilowatt-hour consumption for 12 months: January, 1,213; February, 1,207; March, 1,540; April, 1,551; May, 2,371; June, 2,858; July, 2,387; August, 2,689; September, 1,920; October, 1,511; November, 1,307; December, 1,152.
Load-factor, 28 per cent.

MOTOR INSTALLATION.

The following motors installed in this plant are two-phase 60-cycle 220-volt.

No.	Horse-power.	Speed R. P. M.	Application.
1	5	850	Belted to a two-ton Brunswick compressor.
1	2	900	Belted to a rotary pump which circulates brine through hardening tank and serving cabinet.
1	5	1,200	Belted to a line shaft driving ice-cream machine and bakery machines.

Plant D. Retail ice cream manufacturers.
Total connected horsepower, 9.5. Number of motors installed, 2. Average kilowatt-hours per month, 1,170.
Kilowatt-hours consumption for 12 months. January, 728; February, 541; March, 708; April, 895; May, 1,153; June, 1,785; July, 2,093; August, 1,681; September, 1,549; October, 1,169; November, 895; December, 746.
Load-factor, 22.6 per cent.

MOTOR INSTALLATION.

The motors installed in this plant are two-phase induction machines.

No.	Horse-power.	Speed R. P. M.	Application.
1	7.5	900	Driven direct by chain to four-ton Brunswick refrigerating machine. Direct expansion piping in hardening tank, serving cabinet and refrigerator.
1	2	1,200	Belted to line shaft driving ice-cream machine and bakery machines.

perature of the gas and necessitates the employment of cooling coils, by means of which the temperature is again reduced to the condensing point. The liquid ammonia thus obtained is allowed to evaporate under reduced pressure in a coil of pipe placed in a tank containing brine for the circulating system.

Pumps are required for circulating the cold brine, and these are also motor-driven. An adjustable-speed 35-horsepower motor drives an 800-gallon turbine pump which supplies brine for cooling one of the large chill-rooms, in which the ice cream is set to harden after leaving the freezers. The 800-gallon pump takes the brine from the cooling tank and forces it through the coils in the large chill room on the second floor, while the 400-gallon pump supplies brine to the mixers, freezers and the third-floor chill room. The whole group of freezers are driven by a 20-horsepower motor connected to a line shaft.

Aside from the applications already mentioned, motors are used for elevators, ice crushers and conveyors, exhaust fans for cold storage, and pumps for condenser and cooling water. The list of motors used in various parts of the factory includes 15 machines.

Figures on other plants are given in the data sheet.

Commercial Practice
Management, Rates, New Business

The Practical Side of Electric Irrigation.

The interest aroused by the recent publication in this journal of various arguments on behalf of electric irrigation as prepared by the Southern California Edison Company for distribution in pamphlet form among prospective consumers of this important and profitable service emphasizes the timeliness of a resumé of a booklet by another organization discussing some of the practical problems encountered in the installation of such plants. A large amount of material has been made public from time to time upon the selection and installation of apparatus for irrigation pumping, but in many cases the information given has failed to meet the needs of the electric power salesman along the line of making the important points involved perfectly clear to the ranchman. Recognizing the demand for such a practical treatment of the problem that even the layman might find the information valuable, the Pacific Gas & Electric Company, of San Francisco, has also prepared a pamphlet on "Electric Irrigating Plants," and the material gathered supplements that in the Southern California Company's booklet in a most striking way. The latter confines itself very largely to winning over the ranchman to electric service; while the former, though in no sense neglecting the polemics of the case, confines itself mainly to the problems of equipment selection, methods of construction which have been found satisfactory and some of the pitfalls to avoid in buying machinery. The two booklets constitute an arsenal of facts and arguments of the highest value to the practical central-station man. The Pacific company's publication is a 24-page pamphlet and includes a number of photographs and drawings which are helpful in the study of the general problem.

In the introduction, this booklet emphasizes the necessity of supplying water artificially to growing crops in the far West, and points out that irrigation has taken 40-acre tracts of land and made the owner as wealthy and as independent as his brother with four times that amount of land in Ohio or Iowa. Where the land is underlaid with water-bearing strata, the electrically driven pumping plant, owned and operated by the ranchman, has proved an ideal method of supplying water. In a few cogent phrases the reasons for this are given:

"A never-failing source of power is brought to your home. This power not only furnishes you with water, but furnishes light and many devices to ease the labor of farm life. But these advantages are incidental. Where the individual electric pumping plant is installed, you are not dependent upon the supply of water available, or on the demands of your neighbors. When your crop needs water you start your own pump and give your land as much or as little water as it needs. When through you stop your pump and your expense stops with it. No complicated or expensive machinery is required. Neither is a skilled mechanic required to keep it running. It is these advantages of complete control over the water, coupled with reasonable first cost for machinery, and a cost for operating within the reach of every land owner that has made and is keeping the electric-driven pumping plant the most profitable water supply for irrigating yet developed. With our service extending over the most fertile counties of California, it is to be expected that we should foster this method of developing agricultural resources. It is to your advantage that your land yields a maximum profit. It is to our advantage as a public-service corporation that the community we serve shall be prosperous."

The pamphlet covers the subject under the headings: "General Description of a (Typical) Pumping Plant," "Well Development and Pit Construction," "Installation of Horizontal Pumps," "Installation of Vertical Pumps," "The Electrical Equipment," "Factors to Consider in Choosing Pumps," "Operating Hints," "Water and the Investment," "Water Measurements." A number of views of typical power house and irrigation installations are also included, and in conclusion a list of twenty single-line arguments in favor of the electric drive is printed, with a reference to the willingness of the nearest district manager to talk over specific irrigation problems. The plant description explains the forms of construction usually adopted, the methods of supplying electric power, how to support motor and pumping equipment, and the way to prime pumps. Practical instructions are given in connection with the development of wells, construction of pits and waterproofing. Much useful information in connection with piping layouts is included.

Under electrical equipment the company emphasizes the importance of weatherproof and fireproof wiring, explains the principal electrical devices used, and advocates selecting a motor of ample capacity for the work, instead of purchasing under-rated motors as sometimes is recommended. The selection of pumps is also treated from the point of view of the ranchman, special emphasis being laid upon the saving of at least 15 per cent in power by employing a direct-connected unit, the need of avoiding pump designs having complex water passages, and the importance of purchasing equipment free from vibration. The operating hints deal with lubrication, pump capacities, heads, cleanliness and other points encountered in running such plants. Under investment the company states that first cost per acre irrigated is generally less with electricity than when ditch rights are purchased. Crop failures are unknown where electric power is available for such service. A plant of five-inch discharge ca-

pacity should irrigate under most cases at least 40 acres, and the cost of all equipment and materials will rarely exceed $800. The water-measurement section gives a table of flow to be used in connection with weirs, the construction of which is illustrated in the booklet.

Among the illustrations given are those of a 145-acre alfalfa ranch irrigated with a 20-horsepower motor driving a 7-inch pump. Another of 20 acres of fruit and 40 acres of alfalfa is irrigated by a 6-inch pump and a 15-horsepower motor. Twenty acres in vegetables are irrigated by a 3-inch pump in another case. The arguments at the close of the booklet are given below.

"Irrigation by electric pumping is superior to any other method because:

"The water is under complete control of the owner.

"The irrigator is not dependent upon his neighbors.

"The water flows in an instant, day or night.

"The machinery has no complicated parts to keep in repair (induction motors are used almost universally for this service).

"There are no boilers to explode.

"There is no gasoline tank to catch on fire.

"It is cheaper to install.

"It costs less to operate.

"The cost of power is the same every year.

"It is easily and quickly started.

"It is 'on the job' day and night.

"It brings power to the barn for doing chores.

"It brings light for sudden emergencies.

"It brings a lower insurance rate on barn and house.

"It brings a cool breeze for the hot summer day.

Increasing Loyalty of Employees.

Final preparations have been made for the outing at Glenwood Park, near New Albany, Ind., which will be given with the United Gas & Electric Company and associated companies as hosts and the 400 employees of the companies as guests. The affair will be held June 1, and will mark the completion of ten years of ownership of the properties. This is one of the ways the United company has been creating the strong spirit of loyalty and interest in the progress of the company which marks its employees. Another method is through the Boosters' Club, which has concluded its operations until fall, a meeting May 14 marking the end of the season's work. The club has finished two years' work, and according to officers has more than justified its existence in bringing about a fine espirit de corps in the organization of the service company.

POWER DATA FOR NEW-BUSINESS DEPARTMENTS.

By E. L. Callahan.[1]

The obtaining of new business has become a distinct and important line of work in every well organized public-utility company. Any work of this nature will meet with better success if carried on under departmental management where discipline can be had. The experience and training of experts in particular lines exerts a strong influence upon those in the department who have not had the opportunity of special training or rubbing elbows with men who have earned the title of experts.

The successful new-business men who are recognized today for their ability as power, illumination or sign "business-getters," or as new-business department managers, owe their success usually to salesmanship acquired or inherent. But with salesmanship a vast amount of technical and general knowledge must be at hand. It is dangerous to depend upon the best memories too implicitly; besides, organizations of today are not of the one-man-power type.

Hence the tendency of the times is toward the maintenance of the best possible efficiency and the organization of commercial or new-business departments.

The best results in any undertaking are accomplished through specializing. A salesman who devotes his entire attention to electrical advertising will close more business and for better signs than a man who is more experienced in obtaining general illumination or power, and vice versa. This is particularly true of soliciting for power business. This class of business is the most desirable central-station load and very consistently is the most difficult business to obtain—usually in direct ratio to increase in load-factor. The new-business department of H. M. Byllesby & Company has a large corps of commercial engineers who are proficient, not only in testing and reporting on requirements, but in closing, power contracts of all kinds. Notwithstanding the fact that this talent was available and much data likewise, there was a need of properly tabulated data and information on results of tests, systematically arranged in a form that would be available to all salesmen.

Such data and information as was needed by salesmen to convince prospective customers that the salesman was not in error in estimating requirements was secured from actual installations of power and illumination, and carefully arranged and tabulated in loose-leaf form held in a pocket binder. The first issue covered about 200 installations with such general description as was necessary. The second issue of sheets was made January 1, 1912, making a book of about 300 sheets.

These data cover the largest possible field of power business. The information is accurate and taken only from installations operating upon lines of H. M. Byllesby & Company. The usual question of a prospective power user is "how much will the current cost me per month or per year?" There is data from so many installations in the book that the question is readily answered. By selecting an installation that is nearly identical with the one in question, and from the figures giving 12 monthly kilowatt-hour readings, the prospect is easily convinced that the solicitor has named the approximately correct kilowatt-hour figures for his installation.

There are numerous average kilowatt-hour, load-factor and running hour figures which tell the whole story for each installation whether for power, light or combination operations.

This book has closed many a contract for central-station service for the Byllesby company. It was compiled by our chief power expert and cost a considerable amount of money but it has proven to be almost invaluable to our new-business power men.

In order to pass a good thing along, we have turned the book over to the Committee on Commercial Section Digest of the Commercial Section, National Electric Light Association. Practically all data given in the Byllesby Power Data Book will be reproduced in this Digest and will be distributed to each Commercial Section member of the National Electric Light Association. The Byllesby company trusts that this book will be of as much assistance to power men throughout the country as it has been to members of its new-business department.

[1] Manager New Business Department, H. M. Byllesby & Company, Chicago.

New Office Building for Great Western Power Company.

The Great Western Power Company, of San Francisco, has completed plans for its new leased six-story building, which it expects to occupy within five or six weeks.

The cashier's desk and the "service" desk will occupy a portion of the ground floor. The remainder of the ground floor will be utilized for a display of electrical appliances. On the mezzanine floor will be the "electric shop."

The second floor will consist of an as-

sembly hall and a library for employees. The executive offices will occupy the fourth floor. The third, fifth and sixth floors will be devoted to the general offices and the different departments of the business. The roof will be transformed into a sun room, with an electrical kitchenette for the use of women employees.

Relative Electrical Development in the Different States of the United States.

The accompanying table shows in a rather unique and interesting manner the percentage of population in each state of this country which is accessible to central-station service. In compiling this table the population of the various communities in each state having a central-station company was obtained, and the percentage of these to the total population of the state computed. It is gratifying to note the excellent showing that is made by many of the states of large area and having heavy population. In a few instances low percentages are shown, which indicates a large rural population with comparatively few extensive distributing systems.

PER CENT OF TOTAL POPULATION OF VARIOUS STATES WITHIN DISTRICTS SERVED BY CENTRAL STATIONS.

State	Per cent	State	Per cent
Maine	63.9	Ohio	60.0
New Hampshire	80.2	Indiana	48.8
Vermont	50.6	Illinois	68.0
Massachusetts	97.3	Michigan	56.2
Rhode Island	92.2	Wisconsin	50.0
Connecticut	91.6	Minnesota	48.8
New York	80.4	Iowa	39.4
New Jersey	77.2	Missouri	46.9
Pennsylvania	66.1	North Dakota	16.5
Delaware	57.6	South Dakota	21.4
Maryland	54.2	Nebraska	35.4
Dist. of Col.	100.0	Kansas	35.0
Virginia	26.4	Montana	43.3
West Virginia	23.0	Wyoming	41.8
North Carolina	20.0	Colorado	59.4
South Carolina	18.4	New Mexico	66.8
Georgia	24.2	Arizona	41.4
Florida	35.1	Utah	58.5
Alabama	21.2	Idaho	36.3
Mississippi	16.1	Nevada	47.7
Louisiana	32.3	California	70.2
Texas	29.5	Oregon	56.0
Arkansas	17.7	Washington	62.3
Oklahoma	25.2	Alaska	23.4
Tennessee	23.9	Hawaii	30.7
Kentucky	27.4	Total average	51.6

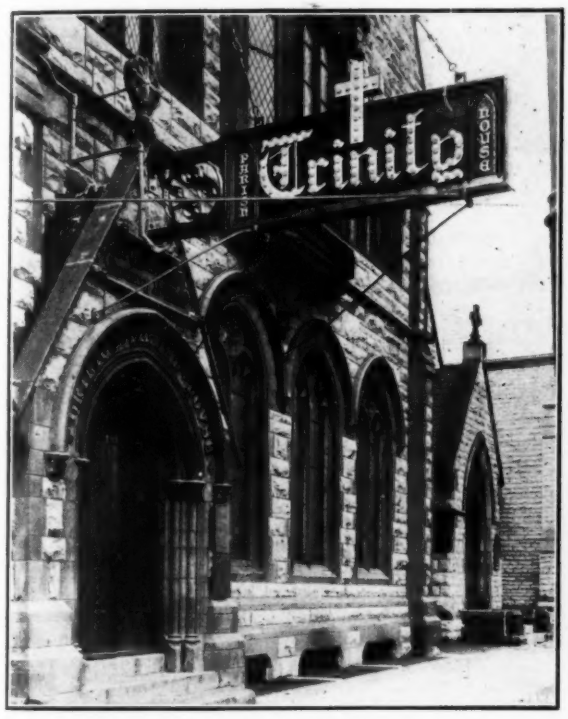
Trinity's Electric Sign.

With the development of the institutional features of Trinity Parish House, the Reverend John M. McCann, rector of Trinity Episcopal Church, Chicago, found himself in a peculiar situation. The Parish House, a beautiful Gothic stone structure, stands adjoining Trinity Church on Twenty-sixth Street at Michigan Boulevard, in what was a decade ago the most exclusive residence district in Chicago. Within a few blocks were the mansions of the city's most famous and influential residents and among Trinity's parishioners are many families prominent in the development and fame of Chicago.

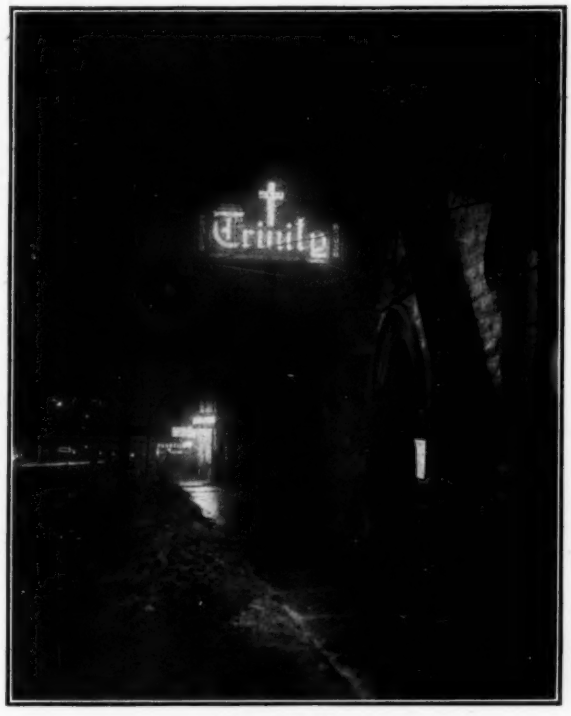
At its best, Twenty-sixth Street is poorly illuminated by the few lamp posts that did duty when it was a quiet residence street. The location of the Parish House almost required a chart and compass after dark, certainly it did not attract or invite anyone to its doorway. Light was needed and the idea of employing an electric sign to mark the entrance was evolved. The problem of designing and erecting such a sign was submitted to the Federal Sign System (Electric) for solution.

Photographs of the building were submitted to architects who prepared a design, the simple Gothic dignity of which blended in architectural detail with the building, and yet did not lose its force and legibility so necessary in an electric sign.

The sign itself was then cast in solid metal from moulds made from the architects' drawings. The faces of the raised Gothic letters and of the cross, which measures two feet high, were made of white porcelain enameled steel. At each end the words "Parish" and "House" in milk-white leaded art glass upon an amber background were illuminated from the interior and blend in pleasing harmony with the bronze surface of the sign.



Trinity Church Sign.



Sign at Night.

Frosted-carbon lamps of 180 candle-power illuminate the letters and the general effect of this golden flood of light is indescribably beautiful. The sign can be read for two blocks in either direction.

Although only 9.5 feet long, and four feet high over all, the Trinity sign is probably among the most beautiful and distinctive electrical signs of its class ever built. It marks the advent of electricity into ecclesiastical usefulness. Energy is supplied by the Commonwealth Edison Company.

Electrical Construction

SOME FEATURES OF SQUIRREL-CAGE MOTOR INSTALLATION.

By George J. Kirchgasser.

The simplicity and ruggedness of the squirrel-cage induction motor, together with its ability to stand heavy overloads and abuse, are the chief points of advantage over slip-ring motors. They are for these reasons in greater general use than the wound-rotor, or slip-ring, motor and are often put to uses for which they are not well adapted. Good starting torque and speed regulation are often sacrificed, and the squirrel cage motor chosen because of the above-named advantages.

They have no commutators, slip rings, or brushes, and no sparking is possible. Only one circuit, the primary, need be controlled and no housing or separate motor room is necessary in dirty or dusty locations. So little attention in this respect is needed that usually none whatever is given. The motor is often installed on some out-of-the-way platform—as in a planing mill, for instance—and practically forgotten, as the starting apparatus may be placed at some distance from the motor.

The induction motor of the squirrel-cage type has, however, the undesirable feature of requiring a heavy starting current. A motor of this type for general industrial use cannot be designed to require too small a starting current, as this would make the performance at other periods of running poor. For starting without load or with very light load a motor can be obtained giving the best operating performance. To increase the starting torque so as to allow starting under considerable load it is necessary to increase the secondary resistance or the starting current. A heavy starting current sometimes blows fuses and opens circuit breakers, causes fluctuation of line voltage and tends to cause an uneven acceleration of speed. Of course, the breaking of the circuit when throwing the handle of a starter compensator from the starting to the running side may also aggravate this last mentioned defect. Increasing the secondary resistance causes poorer operating results, decreasing the efficiency under load.

Small motors are often thrown directly on the line, but they draw a heavy starting current at a very low power factor, thus interfering with the voltage regulation of the power lines. The motor leads are also necessarily overfused permitting large currents to pass to the motor continually, in case of some abnormal conditions.

The National Electric Code says that motor leads shall be of such sizes as to carry 25 per cent more current than the rated amperage per terminal of the motor, but where the wires under this rule would be overfused in order to provide for the starting current, as is the case of many of the alternating-current induction motors, the wires must be of such capacity as to be properly protected by these larger fuses. With squirrel-cage motors this means

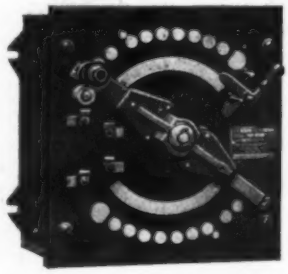


Fig. 1.—Primary-Resistance Starter for Squirrel-Cage Motor.

that the leads must be considerably more than 25 per cent greater, due to the large starting currents. A capacity of 50 per cent greater reduces the voltage drop at starting and permits proper fuse protection.

Squirrel-cage induction motors when driving heavy machines—as hoists, elevators, etc., for instance—may be installed outside, or in a location where fuse protection is of secondary importance. But here also the leads should be of liberal capacity, as the large current demanded to produce sufficient starting torque will cause a voltage drop in the conductors which will in turn decrease the torque. This is especially true if the motor is located some distance from the source, as is often the case in our large industrial plants. If the current is furnished by an isolated plant, excessive demands will be made on the generators, while if supplied by a central-station power company, line disturbances and regulation troubles will result.

The torque of a squirrel-cage motor varies as the square of the voltage impressed on the stator winding, so that if the starting current is large, the conductors should be of such capacity that the voltage drop will be small. So, aside from the electrical inspector's ruling in regard to having the motors leads of sufficient capacity to allow proper fusing, there are still better reasons why this requirement should be observed. Too many times apparatus, motors, etc., give a poor performance because of the lack of forethought in laying out the wiring.

For small two-phase or three-phase squirrel-case induction motors a primary-resistance starting rheostat is sometimes provided, instead of throwing them directly on the lines. This reduces the current and reaction of the motor on the line, and permits gradual acceleration. They are simpler than an auto-transformer and less expensive. A starter of this type is illustrated in Fig. 1. Non-inductive resistance is arranged in two phases of the primary circuit for either two-phase or three-phase motors. Sufficient resistance is provided to give the motor from 40 to 50 per cent of the line voltage when the circuit is first closed. At this voltage the motor will develop sufficient torque for the average condition of starting under light loads. The resistance is so proportioned and has sufficient capacity to permit of starting the motor under partial-load conditions, requiring from 65 to 75 per cent of the line voltage at the motor terminals to start, and taking from the line a current about two and one-half to three times the normal full-load current of the motor.

While the current taken from the line, when starting with the resistance method, is somewhat greater than that taken with the compensator or auto-transformer method, the power-factor of the combined resistance-starter and motor is higher than that of the combined compensator and motor. The wattless current is about the same for the two methods, the line disturbance being somewhat greater for the larger sizes. The cost is also lower. Care must be exercised while starting the motor, to prevent cutting the resistance out of circuit too rapidly at first. The torque is low at first, but increases as the motor speeds up.

The star-delta method of starting squirrel-cage motors consists in arranging the winding of a three-phase squirrel-cage motor so that it can be connected in star for starting and delta for running. When connected in star, two sections of the primary winding are in series across the full line voltage, while in the delta connection only one section is across the full line voltage. On starting, therefore, the current is considerably lower, due to the higher impedance of the motor circuit, two sections of the windings being in series. After the motor has come up to speed, the connections are changed to delta and each section of the winding gets its full rated voltage. This method of starting is essentially applicable to smaller motors and the double-throw drum-type switch is very simple. In appearance this is similar to an auto-transformer starter, as the mechanism is immersed in oil and inclosed in a sheet iron tank. The operating lever is also similar and is so arranged that it is necessary to move to the starting position and pass quickly over the "off" to the running position. Running fuses which are short-circuited on starting are usually provided, mounted on the back of the inclosing tank.

In all plants some manner of impressing upon workmen the importance of properly handling the motors and starters should be of value in reducing repairs and maintenance, etc. Imposing signs with plainly written instructions are being used now to a considerable extent in industrial plants.

The method of starting the squirrel-cage motor in general use is by use of a starting compensator or auto-transformer—see Fig. 2. The voltage is reduced for starting duty by throwing the handle to the starting position, and then by throwing the handle to the running position the motor is connected directly to the lines with full voltage applied. These starters have duplicate terminal leads, one set for starting and one set for running. Large fuses are often put in the starting leads while those of proper capacity are placed in the running leads. The trouble as found in everyday use is that the squirrel-cage motor is used for starting under load, and, also, the starting handle is thrown too quickly; that is, before the speed has increased sufficiently, full line voltage is applied. This invariably blows the fuses in the running leads so they also are increased beyond the capacity which when installed proved satisfactory.

A starting compensator having one starting and one running point is cheaper than a multi-point compensator and is used almost exclusively. In many cases the latter would prove of advantage, although lowering the impressed voltage reduces the torque. Several taps are supplied with these so that the impressed voltage can be applied in increasing percentages of the normal line voltage, giving a gradual speed acceleration with less wear and rack on the machinery driven and with less line disturbance. With taps producing 40 per cent to 50 per cent of full line voltage for the first step, with succeeding steps of 60 per cent, 75 per cent and 100 per cent, uniform acceleration would be assured with sufficient torque for the average conditions of starting under medium load, for which squirrel-cage motors are adapted. Of course, even with this type of starter there is the liability of the handle being thrown over the consecutive points so rapidly as to lose the advantage offered and allowing full voltage to be applied before proper speed is attained.

The old type of open-blade, double-

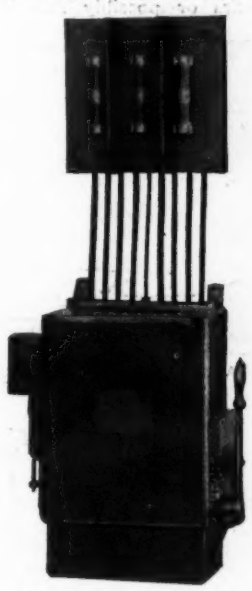


Fig. 2.—Compensator Starter with Running Fuses and Panel.

throw compensator is a very poor apparatus for use with squirrel-cage motors. The same set of fuses is in circuit when the switch is on the starting and the running side. This fact has not generally been considered in planning the motor installation, with the result that very few of these old equipments are in accordance with the requirements of the National Electrical Code.

These starters are also objectionable in damp, dusty or dirty locations because of the open-blade contacts, and also are objectionable because of danger to operators. They permit of only one running and one starting point. As this switch remains in the running position if the current supply is interrupted, a large inrush of current results, following the return of the current after an interruption. The writer recently visited a school building and found the 50-ampere fuses originally placed in the leads to a three-phase squirrel-cage motor driving a ventilating fan, replaced by three 125-ampere fuses. The conductors were No. 6 rubber-covered wire having a specified carrying capacity of 46 amperes. The interruption of the current supply at times when the janitor's work took him to remote parts of the building would leave the motor connected to the lines directly, the switch being in the running position. A return of current would allow full electromotive force voltage to be applied to the motor, therefore blowing the fuses because of current inrush. In this particular case the superintendent of the power company had been called up and at once said he could easily remedy the defect and prevent a similar occurrence; he put the 125-ampere fuses referred to above in the leads.

A fuse will carry 10 per cent above its rated capacity continuously so that in this case, if an overload, hot box, or other defect should have occurred, about 140 amperes could have passed continuously through the No. 6 conductors, a 75-ampere switch, the starting compensator and the coils of the stator winding, the fuses being of no value except in case of a short-circuit.

The induction motor is peculiarly subject to fuse troubles, and yet authentic data regarding proper fusing of alternating-current motor leads is very scarce. It is a very common practice—and a poor one—to put in fuses of a certain size at a guess and then if they blow simply to put in large ones regardless of protective value.

At the meeting of the Electrical Committee of the National Fire Protective Association, March 22, 1911, the matter of the wiring and fusing of induction motors was considered and amendments recommended. One is that "where rubber-covered wire is used for the leads or branches of alternating-current motors of the types requiring large starting currents, the wires may be protected by fuses in accordance with Column B of table No. 16—now No. 18—National Electrical Code." Column B gives the allowable carrying capacities for wire with insulation other than rubber, such as weatherproof, and these capacities are more liberal than for Column A.

A safe practice for wiring to induction motors, especially the squirrel-cage type, is to use leads of 40 per cent to 55 per cent greater carrying capacity than that of the indicated "Amperes per Terminal" of the motor. If a motor has a rating of 43 amperes per terminal, 43 multiplied by 150 per cent, or 64.5 amperes, is practically the capacity for No. 4 rubber-covered wire as given in Column A, Table 18, National Elec-

trical Code. The amendment noted above permits fusing according to Column B of the code, which for No. 4 is 92 amperes. Starting fuses of say 90 amperes would be proper and about 60 or 75-ampere fuses in the running leads would be right. Of course, where the leads to the motor are of considerable length, voltage drop must also be considered in selecting the size of conductors. Also, on a three-phase system the voltages between the legs 1-2, 2-3 and 3-1 should be approximately equal. If not the maximum output is affected, as well as the current in the various legs. Fuse or fuses in one or two legs may blow because of greater current in those legs. The same applies to two-phase systems.

Central station and inspection bureaus have in some places, as a means of guidance of electrical contractors and for the protection of power-station apparatus and safety, issued printed instructions regarding the leads and fusing of them for alternating-current motors. While the table below does not consider drop and refers to any type of three-phase motor, it indicates that strict ruling is necessary These data for three-phase, 220-volt motors are in use in Chicago by the department of electricity and are calculated on the basis of 90 per cent efficiency, 85 per cent power-factor and 50 per cent overload:

Horsepower	Amperes per phase	Size of wire Concealed	Open wiring
1	3	14	14
2	6	14	14
3	9	12	14
4	11	12	14
5	14	10	12
7½	20	8	10
10	27	6	8
15	40	4	5
20	50	3	4
30	75	0	1
50	125	4/0 Circular Mils	3/0 Circular Mils
75	185	300,000	250,000
100	250	500,000	350,000

Some device, as a series relay, is needed—and should be recommended—especially for two and three-phase motors, which could be installed in the running side and set for a desired amperage. A circuit-breaker is better than fuses although the operator is enabled to change the adjustment. If locked for a certain amperage—which had been found to give the operation desired of the motor—an operator would know that some abnormal condition existed if the circuit-breaker tripped. This might mean that he did not allow the motor to reach the proper speed before throwing to the running position, in which case he could throw in the breaker and try again. If all efforts failed it would indicate that the motor was loaded up more than usual, that the shafting was out of alignment, or that possibly some defect had developed in the motor itself.

With all polyphase motors either a part of the starting device or a separate device should operate to cut all phases of the motor from the line in case of trouble so that current cannot continue to flow in one phase as often occurs. Series relays, if properly adjusted, will protect the motor against running single-phase but if not properly adjusted they will not be tripped by the increased load on one phase.

I was at hand recently when a 10 horsepower three-phase 440-volt squirrel cage motor of standard make was burned out. This motor, used for pumping purposes, had been in operation only a few months and therefore caused great surprise upon its sudden indisposition. An examination of the fuses revealed the cause. One fuse had blown causing the motor to run single phase. The load was normally slightly above 10 horsepower, and this abnormal condition existing for several hours or possibly several days finally burned out the overworked phase winding. A circuit breaking device cutting out all the phases would have prevented this accident if set properly. But if the two fuses which did not blow and which allowed the single phase to burn out had been smaller than two and one-half times the capacity of the leads, they also might have prevented the damage because they would have blown. Protective devices are too often not used for the purpose for which they are manufactured. A fuse is considered protection regardless of its amperage rating. What is needed is a device which can be locked by the superintendent at an amperage known to give the desired results.

Starters are made for use with squirrel cage motors which control the acceleration automatically. The acceleration occurs in a length of time consistent with the starting current which can be adjusted as desired. A current relay in the motor circuit cuts out resistance in the small starters of this type while in larger types auto-transformers replace the primary resistance for reducing the voltage.

A self-starter—really an automatic compensator—of this type illustrated in Fig. 3—transformers not shown—is especially adapted for use with two or three-phase squirrel-cage induction motors driving centrifugal pumps, or similar machines. For small motors one starting point is provided on the standard apparatus while the large sizes have two starting voltages about 50 per cent and 75 per cent. The rate of acceleration is controlled by current relays in the motor circuit, which hold the motor on the starting step until it has accelerated in proportion to the voltage of that starting point. The motor, at the proper time, will be transferred to the next step and held there until the speed again accelerates. If two starting positions are furnished the next step will throw the motor on the lines and cut the auto-transformers out of circuit. The acceleration is therefore governed by the adjustment of the current relays and the starting current can be kept to reasonable limits.

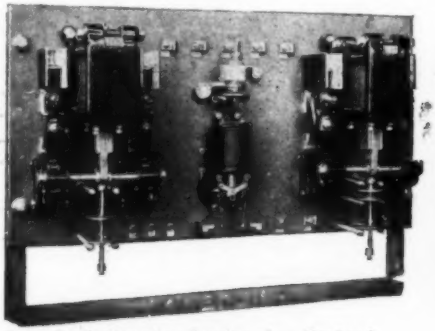


Fig. 3.—Automatic Starter for Squirrel-Cage Motors.

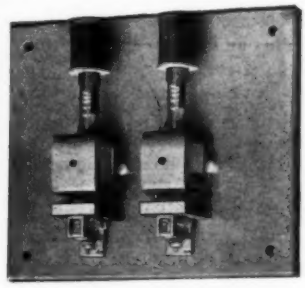


Fig. 4.—Overload Relays.

With starters of this kind it is possible to get the same starting each time, which is impossible with manually operated starters. The leads to the motor can be properly fused and no strains or racking of machines, belts, gears, etc., results from excessive and sudden current inrushes. Remote control can be arranged also with starters of this type. Upon interruption of current the starter returns to the starting position.

In all cases for any type of motor, the choice of the starting apparatus should receive careful consideration. The operation of the motor depends to a considerable extent on the controlling apparatus. These should be selected according to the duty they are to perform, and should not necessarily correspond in horsepower rating to the motor. In the induction motor installations of today the starting compensators provided are often found too small to operate except with the greatest care, which shop hands, as a rule, do not exercise.

When motors are first installed more or less attention is given to the start-

ing, the load is light, shafting aligned, and the starter handled carefully. But later, load is added and the motor is thrown in quickly, blowing the fuses which are then replaced by larger ones.

The tungsten lamp was first installed in a haphazard manner without proper switches, etc., for turning it on and off, and in such a careless manner also, have squirrel-cage motors often been installed. One might almost come to the belief that squirrel-cage motors were the only alternating-current types made. They have been employed without regard to conditions of service, starting load, or to subsequent results. This is the chief reason for the troubles outlined in this article.

Many and various methods have been tried and are being offered to improve the operating conditions of the squirrel-cage motor so that it will have a greater and a more satisfactory use. In view of its advantages of simplicity and ruggedness any improvement relative to its starting conduct will be welcomed. But most of the improvements tend toward complications destroying in a more or less degree the chief advantages possessed by the squirrel-cage type of motor. There are types in which a resistance is inserted in the secondary on starting and cut out by centrifugal force when up to speed; others having two windings, etc.; all rather complicated pieces of machinery.

Concerning the simple squirrel-cage motor in general use, however, more discretion should be used in its application, and when installed, the leads, switch, starter and other accessories should be of very liberal capacity. This will result in better starting operation, less line disturbance, decrease the demand on the generator, and allow proper fusing of motor leads. Installations of this kind would make this type of motor more favorable in all respects, and if provided with some device for limiting the starting current the requirements of the National Electric Code and those of good practice would be well met.

From the trend of the figures for nine months, the indications are that the exports of manufactures from the United States for the fiscal year 1911-1912 will reach one billion dollars in value.

A CONVENIENT PULL-BOX FOR UNDERGROUND SERVICE.

By Miles A. Shadley.

The accompanying drawings illustrate an underground pull-box which may be used to advantage in many cases where electric light and telephone wires are to be run underground. A place where such a box may be used to great advantage, for example, is where in residence work it is undesirable to run open or overhead circuits to a house and the run is too long to pull without a box or opening.

The two figures explain the construction and arrangement of the box sufficiently, it is thought. Fig. 1 is a side view, and Fig. 2 indicates the appearance of the box when looked at from the top, with the observer looking downward on it.

In the instance where I am using a box of this sort, I am placing one at the foot of the pole, since I want to avoid the bend at the bottom of the pole in the first pull.

An 8-B outlet box may be used very nicely in place of the condulet, but it takes more room and therefore makes a larger box necessary.

The saving in the cost of the installation which may be effected by using only one pull-box is well worth considering, as the cost of boxes for underground work is not inconsiderable. In fact, with the kind of work indicated in the accompanying figure, the use of a single box instead of two boxes practically cuts the cost of the installation in half. It also makes a better job. To place two underground boxes side by side when one would answer the purpose just as well would be as bad a job as using two single switch-plates side by side when you could easily get a two-gang plate for the switches. Moreover, the telephone wires get better protection with the sort of installation recommended here than when they are placed in a box by themselves.

It will be noted that the condulet referred to is used in the telephone circuit. The cut has been marked in small letters so as to make room for the complete designation of all the fittings of the box, and to show how the box is assembled.

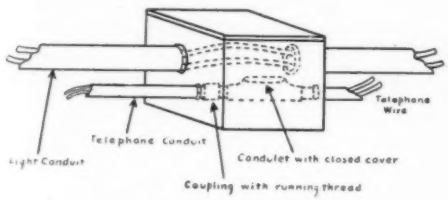


Fig. 1.—Pull-Box with Cover in Place.

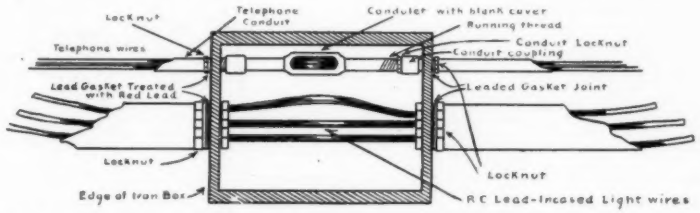


Fig. 2.—Top View of Box with Wires Installed and Cover Removed.

Conduit Construction in Omaha.

The better methods of electric wiring have no stronger advocates than are found among the bureaus of electrical inspection throughout the country. The efforts of inspectors are accomplishing as much as perhaps any other one agency toward the promotion of conduit wiring. In many of the more progressive cities other forms of wiring are not approved at all in certain specified areas. In the city of Omaha, Neb., for example, approved metallic conduit or approved armored cable is required for the installation of all concealed wiring in the wiring of new buildings and the re-wiring of old buildings within the fire limits of the city.

Outside of the fire limits in this city other types of concealed wiring may be used in residences not designed for more than two families, and in other small buildings. Wiring in wooden molding, however, is not permitted, except for minor alterations.

Metal conduit or armored cable is required in the wiring of all basements, except in private dwellings not built for more than two families and where there is to be concealed wiring over finished ceilings or in lath and plaster partitions.

Approved metallic conduit or approved armored cable is required for the wiring of all hospitals, hotels, theaters, public buildings, schools, factories, churches, grain elevators, feed stores, livery stables, meeting halls capable of seating 400 or more people, buildings of fireproof or mill construction, and in all buildings in which the floor space comprised within fire walls on any floor exceeds 6,000 square feet. In the making of minor alterations the city electrician may permit deviations from this requirement.

It is interesting to note further, in this connection, that sockets installed over tile, cement or earthen floors, or when located near sinks, lavatories or the like, must be constructed of porcelain or other insulating material.

The specification concerning sockets is doubtless inserted as a means of safeguarding persons in rooms of the kind mentioned against electric shock. There are other cities having similar requirements, as has been noted in previous issues.

Evolution of the Code.

It is stating a fact already rather well known to say that the position occupied by the National Electral Code is a unique one. So far as the rules themselves go, they are but little more than recommendations. But they have been so wisely drawn and specify so well what is necessary for safety in electric wiring that insurance interests and electrical interests throughout the country accept their recommendations with seldom a question, while municipal boards enforce them as ordinances.

Obviously, such a set of rules as the National Code now is could only be the product of years of careful study and co-operation on the part of specialists. Its present prestige is sufficient, it is thought, to make the story of the beginnings and growth of the Code interesting, and for that reason the main points of the story are given here.

It appears that to the New York Board of Fire Underwriters belongs the credit of the first printed requirements in relation to electric wiring. On October 18, 1881, a circular was issued by that board directing the proper committee of that body to notify the owners and occupants of all buildings in which uncovered electric wires were found that such wires must be covered; also that arc lamps, within doors, so constructed as to permit the dropping of pieces of carbon must be changed. It was recommended that in cases of refusal to comply with this request promptly, the insurance on such buildings be canceled. A few days later the Boston Manufacturers Mutual Fire Insurance Company issued similar rules concerning arc lamps. Early in 1882 both of the organizations just mentioned issued circulars containing a few rules on electric wiring. Soon thereafter the National Board of Fire Underwriters adopted the requirements of the New York Board. In this same year (1882) the Boston Board of Fire Underwriters issued a set of rules, as did the New England Insurance Exchange in 1885.

At a meeting of the National Electric Light Association, in 1885, there were present certain insurance representatives, and the matter of rules for wiring installation was brought up, but nothing definite done. Some rules drawn up a little later by representatives of insurance interests and of the National Electric Light Association failed of adoption by the latter body; but these may be said to have been the first really comprehensive rules yet formulated.

In the first part of the year 1890, six of the insurance organizations issued quite complete sets of rules relative to the installation of electric wiring. In August of this year a joint committee of insurance men and representatives of the National Electric Light Association reported a number of recommendations to that body, and a special conference committee consisting of insurance and electrical men was formed, this committee being known as the National Electro-Insurance Bureau. In 1891 the National Electric Light Association adopted a code of wiring rules prepared by this bureau. However, there was no special effort to bring about the general use of these rules, and they were not widely used. Most insurance boards either modified this code to suit themselves or else kept on using rules which they had previously formulated.

The first very effective effort at uniformity of rules was made in 1892. A convention of insurance men met in New York and made such revisions in the rules which had been adopted by the National Electric Light Association as seemed wise. Copies of these revised rules were sent out with a call to

C. M. Goddard,
A Pioneer in the Development of Electrical Inspection.

a second meeting to be held in December of the same year. This meeting was attended by representatives from insurance boards all over the United States and from many sections of Canada. A permanent organization was effected and an Electrical Committee appointed. This committee consisted of electricians in the employ of insurance interests, and its duties were to be the care of the rules, the making of tests and the giving of information and advice to the Association. The rules prepared at the first meeting of the year were gone over and revised again, and all the members present pledged themselves to do all they could toward having them adopted by their respective boards.

Proofs of these rules were sent to prominent electrical interests, with requests for criticisms and suggestions. The rules were, according to the opinion of such authorities as the Edison Electric Illuminating Company of New York City, far in advance of any heretofore published either in America or abroad. They were widely adopted. In fact, their speedy adoption was so general that within less than a year after the first meeting of the insurance inspectors there was uniformity, so far as insurance requirements were concerned, of wiring installation rules except in New York City and in the South Atlantic and Gulf States.

At the next meeting of the Underwriters' National Electric Association in Chicago in 1893, and at a subsequent meeting in Boston the same year, the rules were gone over and revised again. In February, 1894, they were adopted by the National Electric Light Association; before the close of the year by six additional insurance boards, coming thus into use by insurance inspectors all over the United States. The plan was then adopted of having all the printing of the rules done by the National Board of Fire Underwriters and having no changes made in rules except through this board.

In the meantime a bureau for testing electrical fittings and materials had been established in Chicago, in charge of a member of the Electrical Committee, and quarterly reports were issued containing brief accounts of fires started by electricity wherever such fires occurred.

By 1895 the rules had been adopted by practically all the underwriters' associations, forty of which were using copies of them printed from the same type. Moreover, they had been accorded the approval of many electrical manufacturers and prominent central-station men, and had been incorporated into the ordinances of fifteen or twenty leading cities.

There was still the feeling, however, that perhaps the electrical interests had not had sufficient opportunity to express themselves concerning the rules. So in October, 1895, a communication was sent out, on behalf of the National Electric Light Association, suggesting a joint conference, to be composed of delegates from the American Institute of Electrical Engineers, the American Street Railway Association, the National Board of Fire Underwriters, the American Institute of Architects, the International Fire Chiefs Association, the American Bell Telephone Company, the Western Union and the Postal Telegraph Companies, the General Electric Company, the Westinghouse Electric & Manufacturing Company, and the National Electric Light Association.

From this meeting a National Conference on Standard Electrical Rules was organized in 1896, and a committee appointed to amend and codify the rules. This committee decided that the

rules already referred to as having been promulgated by the Underwriters' National Electric Association were the best ones to take as the basis for a standard set of rules. That committee prepared a number of suggestions for changes in and additions to the underwriters' rules. Most of these suggestions were adopted and the Underwriters' National Electric Association immediately set to work to revise and recodify the rules.

The revised rules were approved by the code committee of the National Conference and promptly indorsed and adopted by the National Electric Light Association and other interested organizations.

Thus there came into existence in 1897 the "National Electrical Code."

The above notes would be incomplete without some reference to the man whose photograph accompanies them. C. M. Goddard, of Boston, is recognized among his friends as the man who has had more to do with the Code than any other one man. A pioneer in the field of electrical inspection, he early became aware of the need for uniform rules to govern electrical installation, and set himself to the task of creating a general sentiment in favor of such uniformity. The assistance he rendered in the creation of the Code attracted such wide attention to his enthusiasm and ability that when the Underwriters' National Electric Association was formed he was made its secretary. Because of the exercise of these same qualities, he was retained in that position until the work of that association was transfered to the Electrical Committee of the National Fire Protection Association, which, it will be recalled, occurred about a year ago. Although the press of other duties makes it impossible for him to continue to devote so much attention to Code matters as in the past, he permitted himself to be made a member of the Electrical Committee. Hence the Code will still profit by his long experience and intelligent grasp of inspection requirements. Mr. Goddard's work during the past twenty years has won for him a standing in the electrical field which is at once unique and enviable.

Glass Poles for Telegraph Work.

According to the *Telephone Engineer* glass poles are now being manufactured for telegraph and telephone work. The glass is strengthened by interlacing and intertwining it with strong wire threads. It is asserted that the glass poles show their superiority over wooden ones by reason of their resistance to the ravages of insects in tropical countries and against the climatic influence of rain, snow and sleet in other countries than these.

Bert LeBron.

Among the younger men in the West who are prominent and successful in the electrical field is Bert LeBron, of Omaha. And an especially interesting fact about LeBron is that he has won out in the game in spite of obstacles which might have discouraged many a more timid man altogether. He learned the electrical business in the school of experience. But he learned it well.

Mr. LeBron was born in Trego County, Kan., in 1879. When he was eleven years old his people moved to Chicago. Here he attended school for two years, at the end of which time it became necessary to undertake to earn a living for himself. It having been decided that he should learn the electrical business, he went to work with the Western Electric Company. In the five years that he spent with this company he learned armature

Bert LeBron,
Manager, LeBron Electrical Works.

and field winding thoroughly, his work all being in the winding department, where, for a while, in addition to his other duties, he was time keeper. Leaving the Western Electric Company, he became the head of the field-winding department of the Standard Electric Company, and later held a similar position with the Northern Electric Company. After a time he was offered a position with the Omaha Electrical Works, which he accepted. Here he soon became foreman of both the electrical department and the machine shops, and he held that position for five years, the last year and a half of which time, during the illness of the manager, he had entire charge of the plant. A little later Mr. LeBron helped organize the Ore Gas Engine Starter Company, which concern operated a machine shop and an electrical repair department. Soon after the company began business he bought out the electrical department and started in business for himself, as the LeBron Electrical Works. This concern, whose headquarters are at 313 South Twelfth Street, Omaha, does electrical contracting and maintains a large shop for making repairs on electrical apparatus of nearly every description. Besides a large local patronage, it has done work in Kansas, Colorado, and North Dakota.

It is interesting to note in this connection that Mr. LeBron has quite an enviable record as an athlete. He has held the championship in Omaha in boxing and wrestling, and has also won a number of prizes as a bicyclist and as an expert rifle shot. He is a live wire in the electrical field, and a good fellow among an unusually large circle of friends and acquaintances.

Among the Contractors.

The Central Electric Company, of Battle Creek, Mich., has just completed the electric wiring in the new paper box plant of the Michigan Carton Company.

The LeBron Electrical Works, of Omaha, Neb., has been awarded the contract for equipping the bookbinding department of the Beacon Press with individual motors. The service is to be changed from 500 volts direct current to alternating current.

The Electric Motor & Machine Company, of San Francisco, Cal., has recently moved its place of business from 751 Market street to larger quarters at 150 Union Square Avenue. This company, of which George D. F. Smith is manager, does an electrical-contracting and supply business and designs and builds special motor-control devices.

Fitzpatrick & Hoepfner, of Columbus, O., who have the contract for the installation of the mechanical equipment of the Louisville city hospital, amounting to $250,000, have sublet the electrical work to the Sandborn Electric Company, of Indianapolis. The Ridgway Engine & Dynamo Company will furnish engines for the plant and the James Clark, Jr., Electric Company, of Louisville, the generator and motors.

Eugene I. Rosenfeld & Company has been awarded the contract for installing fixtures for the special illumination of public buildings in Baltimore during the Democratic National Convention in June. The firm agreed to wire the City Hall, Courthouse, Fifth Regiment Armory, No. 6 Engine House on Gay street, the old shot tower, and also to provide the fixtures for the display on Bolton street, and to place searchlights on the Emerson Hotel, the Maryland Casualty Tower and the Belvedere Hotel. The firm's bid was away under its nearest competitor. This was because it has the fixtures used in previous illuminations of streets and buildings. These fixtures have previously been rented to the city.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Removing "Knockouts."

[In a recent issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, a "wiring kink" by W. L. Dimelow illustrated and described a method of removing knockouts from outlet boxes with pliers. This "kink" gave a gratuitous suggestion to contractors with respect to ordering outlet boxes with certain kinds of knockouts. This is entirely beyond the function of this column, and the paragraph as printed was an inadvertence, as we do not wish to endorse any particular form of knockout. We are thoroughly aware that there are several types of outlet boxes with "cut-out and wedged-in knockouts" that are widely used in construction of this character. With boxes of this kind the knockout can be removed very easily and expeditiously without bungling of any kind, and the publication of the suggestion referred to was uncalled for.—ED.]

How to Avoid Marring Metal Fixtures.

In hanging ceiling fixtures having sliding canopies much damage is often done to the finish of the fixture stem by bits of plaster, scraps of insulation and the like, which collect in the canopy, and which when the latter is pushed up scratch and score the stem surface. This can be prevented by spreading a handkerchief or other cloth over the mouth of the canopy and fastening the cloth around the stem by means of a string or friction tape. The cloth should be fastened in this way before the fixture is screwed in place. It will prevent matter of the kind just mentioned from lodging in the canopy.

When the cloth is taped to the stem, care should be taken not to allow the tape to touch the metal, as it is almost impossible to remove the gummy substance from the brass.

Another way of accomplishing the same object is to form an inverted funnel around the fixture stem, just above the lowered canopy, out of a sheet of paper.

When the canopy on a fixture which has been in use for some time is to be lowered it will usually be found to contain more or less sand and grit. If the fixture is taken down, of course this can be dumped out; but if the canopy is to be pushed back into position before the fixture is taken down, I have found it a good practice to blow the dirt out by means of a piece of rubber tubing or flexible non-metallic conduit.

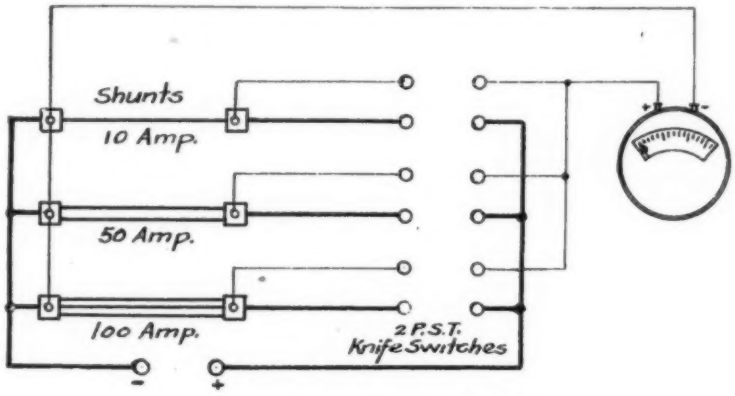
H. A. Calderwood.

Would the Meter Read Direct on Each Shunt?

When using a shunt ammeter it is often necessary to change shunts in order to get a reading well up on the meter scale, or to prevent the needle from going off the scale due to current in excess of the capacity of the shunt then connected in.

The sketch shows a convenient method of accomplishing a rapid change of shunts. Any number of shunts of different capacity may be used, the two-pole, single-throw switch connected to each having corresponding current carrying capacity.

The sketch is self explanatory. With the 100-ampere switch in and the others out the meter will indicate 100 amperes on full scale. If a current greater than the capacity of the largest shunt is required to be measured, both 50 and 100-ampere switches may be closed, in which case the range of the meter will be 150 amperes.



Arrangement of Ammeter and Shunts.

The two positive and negative terminals are connected in series with the line and the apparatus under test.

Frank M. J. Murphy.

A One-Man Meter-Testing Outfit.

I recently changed our system of meter testing, so far as instruments of the smaller capacities are concerned, so that testing can be readily done by one man instead of requiring the services of two, as was formerly the case. The saving has been so great that I am giving an outline of my method here, in the hope that others may profit by it.

Formerly two men were needed to carry the testing apparatus around, as well as in making the test itself. I have reduced the kit, however, to two things—a portable wattmeter and a box which serves both for a testing load and for a tool box. This last is a sheet-metal box 14 inches high, 7 inches wide and 5 inches deep. It contains resistance coils of asbestos-covered iron wire, the coils being wound back on themselves so as to be non-inductive. On the top of the box, which top is made of sheet asbestos, there are seven single-pole switches. By closing these switches one at a time the coils can be made to take a load of from a quarter of an ampere to five amperes and a quarter, depending on the number of switches closed. This applies to a 110-volt circuit. On 220 volts they take twice as much current, of course.

We make our tests without taking the meter to be tested down. A temporary shunt is run around the meter by means of short jumpers, so that the consumer's wires may be kept disconnected from the load side of the meter during the test without interrupting the service. The potential leads of the wattmeter used as the standard are connected to the line ahead of the meter under test, and the series coils of the standard and the meter under test are connected in series with the load supplied by the box. We test our meters for 10, 50 and 100 per cent of their rated capacity.

Charles Reimenn.

Prolonging Life of Ignition Batteries.

In my experience with motor boat ignition I have found that if the battery box is filled with tar after the cells are connected, the life of the battery will be prolonged. The tar keeps the cells from drying out.

This plan also greatly reduces the trouble with loose connections, short-circuits, and the like.

Before the tar is put in the box it should be warmed sufficiently to make it pour readily.

E. M. Seagrave.

Among the Supply Men

The Union Electric Company of Pittsburgh, Pa., the selling organization of which covers western Pennsylvania, western New York, western Maryland, West Virginia and eastern Ohio, is one of the most enterprising and progressive supply houses in the country. This company no only has one of the biggest warehouses in the country, but its retail store, which is handled as an entirely separate part of the organization and located in a different part of the city, is on a par with the most completely equipped department store for its attention to detail and attractiveness both to the man on the outside and the customer inside. The retail store of the company is located on Wood Street in the busy portion of the Pittsburgh shopping district, and the window displays are the talk of the town. As a matter of fact, the crowds in front of its display window have at times become so great that it has been necessary to have special police appointed to keep the street open for traffic. The company plays no favorites, and although it handles certain lines of specialties, its window displays are given up to conspicuous exhibits of practically everything that might appeal to the passerby and stimulate his desire to purchase more and better current-consuming devices. The officers of the company are George W. Provost, president; J. P. Provost, vice-president and secretary; C. P. Miller, treasurer; Thomas M. Cluley, acting vice-president and purchasing agent. George W. Provost and George A. Schardt, assistant sales manager of the company, will accompany the Pittsburgh Chamber of Commerce excursion on its annual business jaunt the week of May 20-25.

The Mohawk Electrical Supply Company of Syracuse, N. Y., maintains a fully equipped store on one of the two main streets of Syracuse. The wholesale store, receiving and shipping departments are located in a fireproof building connected with the stores and retail stockrooms by an underground concrete passageway. The store, offices and retail stock occupy two floors each 100 by 25 feet, and the wholesale stockroom and warehouse occupy four floors 100 by 40 feet. The company covers New York, eastern Ohio, northern Pennsylvania, and western Massachusetts. A growing interest is being noted upon the part of the central stations in their territory to increase their load by the use of electric heating devices. While this is ordinarily true in the larger cities only, it is found that the smaller companies are also getting actively at work along these lines. The business was established in 1907, in Utica, N. Y., and moved to Syracuse the latter part of December, 1908. A meeting of the salesmen and officers is held once a month. The officers are I. H. Green, president; C. W. Wheeler, vice-president; C. S. Bradt, secretary and treasurer. A. M. Little, manager of the company, is the active head of the business.

The Lorbeer Electrical Supply Company, doing a jobbing business in electrical supplies at Los Angeles, Cal., has opened a branch office and ware room at 633 Howard Street, San Francisco. E. G. Alexander is in charge. A complete line of supplies will be carried in stock at both Los Angeles and San Francisco, which will greatly facilitate the prompt handling of material.

The Interstate Electric Company, Limited, New Orleans, La., operates its retail department as a distinct feature from the wholesale department. The company is conducting a special campaign on K. W. ignition apparatus, Eureka vacuum cleaners, and Pittsburgh series street-lighting systems. The selling organization covers all of the southern states. The company reports business much better than last year, even though a large part of the south is suffering from rains and high water. Special demands are being experienced for series street lighting in every part of this territory, even in the smaller towns. The company held a very successful sales convention the last week in December. The business was established about ten years ago.

B. F. Kierulff, Jr. & Company, Los Angeles, Cal., reports a special campaign on eucalyptus pins and brackets. The company's selling organization operates principally in southern California and Arizona, and its electrical business is principally with central stations and telephone companies for line material and equipment. The company reports business fairly quiet without any special demands, except as mentioned above. The business was established in 1904, and B. F. Kierulff, Jr., who is president and general manager of the company, is the principal owner.

The Northwestern Electric Equipment Company, St. Paul, Minn., publishes a very interesting monthly bulletin called "The Northwestern Buzzer." This bulletin is full of entertaining matter relating to the various lines of material carried by the Northwestern Company, and contains a good deal of news also of what is going on in the trade.

Manhattan Electrical Supply Company Leases New Building.

The Manhattan Electrical Supply Company announces that it has leased the building at 1106 Pine Street, St. Louis, Mo., and will open a branch store on or about June 15, with a full and complete line of its own manufactured goods and general supplies. This is the location that was occupied by the Ewing-Merkle Company for a number of years. This store will be under the direct management of F. M. Pierce, who is also the manager of the Chicago branch. The company's general offices and sales rooms are at 17 Park Place, New York, N. Y. The officers are H. T. Johnson, president; J. J. Gorman, vice-president; E. Whitmore, secretary and manager; B. H. Ellis, treasurer.

Auxiliary Power for Wireless on Ships.

The British shipbuilding concern that built the *Titanic* and other big ships of the White Star Line, has just installed upon the new White Star liner *Megantic*, and has made arrangements with a large engine and electric works to deliver for other ships, a special emergency electric dynamo and gas engine for use in delivering energy for the wireless apparatus and the lighting of ships when accident has rendered the regular power equipment of a ship useless.

The United States produces nearly one-half of the total copper output of the world.

Public Service Commissions

NEW YORK.

The Public Service Commission, Second District, has received notice that the West Shore Home Telephone Company and the Rensselaer Home Telephone Company were merged with the Albany Home Telephone Company on March 6, 1912.

Through the intervention of the Commission, difficulties between the village authorities of Homer, Cortland county, and the Cortland County Traction Company, which furnishes light in that village, have been adjusted. On the contract which the company had been furnishing street lights to the village the charge was approximately twenty-cents per lamp per night on a moonlight schedule. The village board determined to construct a municipal plant for the lighting of the streets and also to enter into competition with the existing company for commercial lighting throughout the village. The consent of the Commission was necessary for the village to enter into the commercial lighting field and at a hearing held at Homer on the application of the village for consent to engage in commercial lighting, Chairman Stevens, who presided at the hearing, succeeded in bringing the village officials and lighting company to an understanding. Both agreed to abide by the decision which Chairman Stevens would fix as to the price to be paid for street lighting. After going fully into the merits of the case the chairman decided that thirteen cents per lamp per night was a proper and reasonable charge. This has been accepted by both sides and Village President W. G. Crandall writes the Commission that a satisfactory lighting contract has been executed between the village and the Cortland County Traction Company. For the next five years street lamps are to be furnished at the rate of thirteen cents per lamp per night until one a. m. Commercial lights are not to exceed ten cents per kilowatt-hour with 10-per-cent discount for cash payments within 10 days. In a letter from the village president he states that this arrangement is very satisfactory and expresses the hearty appreciation of the village officials of the great benefit obtained through the attention and action of the Commission.

The Public Service Commission, Second District, has received an application from the Long Lake Light, Heat & Power Company for approval of a franchise and for permission to construct electric lighting plant in the town of Long Lake, Hamilton County. At present, there is no provision for electric lighting in this village. The company expects later to operate at Indian Lake, also in Hamilton County. The company also asked authority to issue its common capital stock to the amount of $8,000, the proceeds to be used for the construction of a plant.

The Commission has received an application from the Red Hook Light & Power Company, asking for a rehearing on the order made by the Commission directing it to extend its lines to provide lighting for Christ Lutheran Church at Binghams Mills in the town of Germantown, as required by the provisions of the franchise originally granted to the company. The complainants also proved at the hearing that there was a contract made with a former general manager of the company that service would be extended to the church when it was wired for lighting.

The Red Hook Company takes the ground that the proceedings to enforce the provisions of the contract should not be brought before the Commission but in an action for damages in the Courts and that the Commission could require the company to extend its line to the church only on the theory that public necessity and a convenience required it and that a fair return would result to the company by such extension. The company alleges that if it complied with the requirements of the order, a loss of several hundred dollars per year would result. As to the requirement in the franchise, the petition for rehearing alleges that no specified time was provided when the main line in the town of Germantown should be completed.

The Commission has authorized the Granville Electric & Gas Company of Granville, Washington county, to issue $12,500 of its 5-per-cent 30-year bonds to be sold at not less than 95 and the proceeds applied to the payment of outstanding bills payable, incurred for the proper capital purposes. The order is made on the condition that the Granville Electric & Gas Company shall reform its accounts and retire $50,000 of capital stock. The company is also required to submit for the approval of the Commission an inventory of its plant and property. The company is authorized to execute and deliver a mortgage upon all its plant and property to secure an issue of 30-year 5-per-cent bonds to the amount of $400,000 and to issue thereunder bonds to the par value of $200,000. $150,000 of the proceeds of the bonds are to be used to take up underlying bonds heretofore issued and the remaining $50,000 to be sold at not less than 95 and the proceeds to be used for the refunding of liabilities shown by the company's books, and for new construction which will cost $14,563.04.

The Commission last week adopted the route for the proposed tunnel under the East River from Manhattan to Brooklyn, which will be used by the Brooklyn Rapid Transit Company in carrying out the dual plan for subway extension. This route departs from the Broadway subway in Manhattan at Trinity Place and Morris Street, and will run through Beaver Street and Old Slip to the East River and under the river to Clark Street, Brooklyn, continuing up Clark Street to a junction with another subway in Fulton Street, also to be operated by the Brooklyn Rapid Transit interests. On the Manhattan side connection is also provided with the Centre Street loop. This is the second tunnel to Brooklyn provided for by action of the Commission within a month, the other one being the Whitehall-Montague-Street tunnel, which will be used by the Interborough Rapid Transit Company to connect the new Seventh Avenue subway in Manhattan with the interborough subway lines in Brooklyn.

Chairman William R. Willcox of the First District Commission has made a public statement in regard to the veto by Governor Dix of the appropriation of $350,000 as the State's quota for the elimination of grade crossings in New York City during the year 1912. The Chairman pointed out that the $500,000 appropriated in 1910 and 1911 had all been allotted for elimination

work which is now under way, and although the money still remains in the State treasury owing to the fact that under the law it cannot be paid over until the work is completed, the need for the additional appropriation made in the supply bill this year is pressing. There are more than 400 grade crossings within the city, and in four years 90 persons were killed and 136 injured at these crossings. The Commission this year asked for an appropriation of $1,000,000, but this was cut down to $350,000. Under the law the cost of such elimination is borne one-quarter by the State, one-quarter by the City, and one-half by the railroad company, but it is impossible for the Commission to order such work done until the State shall have appropriated its quota. By the veto of the $350,000 appropriation, elimination work to cost $1,400,000, which the Commission was about ready to order, has been made impossible this year. The Governor's veto, it is understood, was based upon the fact that there was $500,000 still standing to the credit of the Commission for this work.

MARYLAND.

The case of Victor G. Bloede, president of the Patapsco Electric & Manufacturing Company, owners of a small power plant on the Patapsco River, near Baltimore, against the Consolidated Gas, Electric Light & Power Company charging discrimination in prices has been dismissed by the Public Service Commission.

The case has been before the Commission for several months and numerous hearings have been held. The Patapsco company, through Mr. Bloede, charged that lighting was being supplied in certain parts of Baltimore county, by the Consolidated or its subsidiary companies, and especially in the territory in which the Patapsco company operated, at a less price than it was supplied in other parts of the county where there was no competition; that the rates were grossly unfair and discriminatory.

The Commission finds that the County Commissioners of Baltimore County have designated certain areas as districts for public lighting and in making contracts these contracts specifically state the districts in which the lighting is to be done; that the Mount Washington Company is, as alleged, a subsidiary of the Consolidated, but that neither in the fixing of rates nor in its general management has the Consolidated in any way controlled it; that the Baltimore County Water & Electric Company had no connection with the Consolidated at the time of the Catonsville contract complained of; that the lighting contracts in the county have been awarded upon competitive bidding; that the existing contract for light in the Catonsville district specifically mentioned in the complaint was awarded to the Baltimore County Water & Electric Company on January 7, 1907, for a term of five years ending June 1, 1912, after competitive bidding, the Patapsco company bidding against it, bidding $65 a year for arc lights and the Baltimore County company bidding $57; that certain contracts were made before the Public Service Commission came into existence and that later contracts were made after the Commission had been formed, and that as to these, the Commission was open to the County Commissioners if they had felt aggrieved at the price charged; no complaint having been made the Commission cannot but believe that the rates were satisfactory.

"We have given full consideration," concludes the opinion, "to all the facts and circumstances in the case and have carefully read the brief submitted by the complainant's attorney and are of the opinion that the complaint is not sustained by proof and we therefore issue an order dismissing it."

Application was made by the Chesapeake & Potomac Telephone Company for permission to take over the Maryland end of the Diamond State Telephone Company, which operates in Delaware and the counties on the eastern shore of Maryland and Virginia. The agreement between the Chesapeake & Potomac and the Diamond state companies, filed with the Commission show that the Chesapeake and Potomac agrees to pay for the property the sum of $515,580.88, subject to a mortgage of $500,000 made by the Diamond State Company to the West End Trust Company, trustee. It is provided, however, that when the mortgage becomes due, each party to the agreement shall pay half of the principal amount, and that in the meantime, each company shall pay half of the total interest charges. The case was set for a hearing on June 13.

OKLAHOMA.

The Oklahoma Commission has continued for the term, all of the cases involving electric utilities which were set for hearing on May 14, including the proposed order to telephone and telegraph companies, requiring the marking of poles and other structures; the proposed order to steam and electric lines for footguards, the case against the El Reno Gas & Electric Company, involving the question of minimum rates and a telephone case asking for physical connections at Weatherford.

The Metropolitan Railway Company secured a reversal of the judgment against it in favor of Mrs. F. P. Fonville, of Oklahoma City, as did the Muskogee Electric Traction Company in the case brought by Millie Stagus, where the company contended that the accident in question occurred on its own private property, where pedestrians were barred, and not on a public street.

The Commission is affirmed by the court in the appeal of Lewis T. Hine, owner of the Lexington-Purcell Telephone Company, vs. B. C. Wadlington, et al. The first complaint before the Commission alleged that the company was discriminating in its rates, allowing some patrons residence phones for $1 and charging others $1.50 and in the same way charging $2 and $2.50 for business phones. The Commission ordered that equal rates should be charged for all.

The company then made application for permission to raise its rates, which was refused by the Commission. The supreme court was asked to order the Commission to certify the evidence on this latter hearing, which was done, but the appeal was not prosecuted further, according to the finding of the court.

Water Power for Rome, Ga.

The Rome, Ga., Railway & Light Company is now receiving power from the Ocoee River station of the Tennessee Power Company, which recently took over the Eastern Tennessee Power Company, in the name of which the project was begun. The Rome company installed a substation to reduce the voltage, and at the same time is keeping its steam plant ready for service. During dry periods when the volume of water is not sufficient to enable the power company to generate as much current as is required, this and other consuming companies will sell power to the company, by a reciprocal agreement which has been adopted. Under this agreement the power company pays for maintaining the steam plants. The Interstate Power Company, which was recently organized in Louisville, Ky., with $500,000 capital stock, has the contract with the Tennessee Power Company for the distribution of electric current from the Ocoee River plants, which will ultimately be three in number, to Northern Georgia, and the contract with the Rome company was made through it.

Indicating the possibility of development of industrial business by reason of the production of cheap power, the Rome Railway & Light Company has been adding an immense amount of business, and is offering energy to large users at rates as low as 1.5 cents a kilowatt-hour

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor.. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 64.—Effect of Sagging Tungsten Filament.—If a wire-type tungsten lamp is hung at an angle so that the filament sags after being heated, does the permanent set thereby produced render the filament more fragile than if it had been hung vertical?—P. H. E., Dixon, Ill.

No. 67. — Trouble With Electric Washer.—We are having some annoyance with electric washers becoming surcharged with electricity to the extent that it becomes very difficult to get the clothes out of the machine. The trouble does not persist and never lasts throughout the washing nor does it appear two consecutive weeks. It seems to appear in only two places out of eight that are identically equipped. The washer used in the writer's home for three months without the slightest trace of current leak, when taken to one of the trouble zones, was immediately charged very heavily, but the trouble disappeared after the first tubful of clothes had been washed. We grounded the motor frame to the castor before trying it. Westinghouse induction motors are used on the machines. What is the cause of this trouble and how can we remedy it?—C. W. G., Washington, Ill.

No. 68.—Data for 60-Cycle Fans.—What is the energy consumption of standard 110-volt, 60-cycle fans of the 8-inch, 12-inch and 16-inch sizes? How is this influenced by the speed, that is, what is the relative consumption at full speed, medium speed and low speed?—H. F. A., Dubuque, Iowa.

No. 69.—Fishing Wires.—In a recent article I read that the use of jointed rods is better for fishing wires in walls than the use of a chair and fish tape. What is the "chair and fish tape" method? What method is used to make the fish tape take elbows and jogs in conduit better than a simple band in the end? I have read of a spiral spring with a ball on the end, yet old journeymen whom I have asked profess never having heard of it. Are these attachments on the market?—C. W. G., Muskegon, Mich.

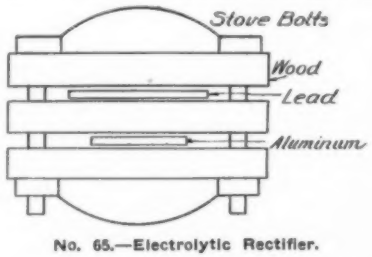
No. 70.—Arrangement of Three-phase Line.—In building a three-phase power line, is it better to put all three wires on one cross-arm or to arrange them in a triangle with one on top? Can the top wire be placed right on top of the pole itself so as to require only a short cross-arm for the two lower wires?—N. T. P., Charlotte, N. C.

Answers.

No. 61.—Opening Exposition From a Long Distance.—After reading that a prominent man had started the wheels of an exposition by pressing a button over 1,400 miles away, I had a dispute with a man who asserted these stories are pure fakes, and that he did not believe it was possible and knew at least one case where merely a telegraphic signal to the operator in a substation had been sent. I contended that a telegraph relay can easily be arranged to control the necessary switches. Was I right?—H. B. D., Faribault, Minn.

It is very easy to arrange a relay circuit or circuits to open or close a switch from a great distance by a single impulse sent over a telegraph line. It requires careful prearrangement to have a long circuit set apart for this purpose, but is not more difficult than to provide a private or leased wire for a commercial house. The opening of important expositions has for a long time been done over a long-distance line, the President of the United States having frequently been called on to press the opening key. The novelty of this has somewhat worn off. It is probable that in some cases the hurry and excitement usually attendant on an exposition opening has prevented getting the relay control for the switch in proper order so that the signal method referred to may have been used. But there is no question as to the practicability of the true long-distance control over a switch. In fact, it has even been done by wireless telegraphy over moderate distances. —L. J., Omaha, Neb.

No. 65.—Electrolytic Rectifier.—I want to build an electrolytic rectifier to use on a 100-volt, 60-cycle circuit and to carry about five amperes. What kind and size of plate are best for this purpose? What solution should be used?—A. F. K., Louisville, Ky.

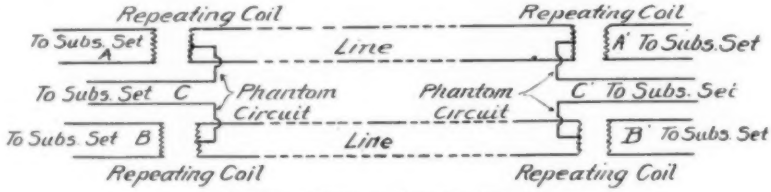


No. 65.—Electrolytic Rectifier.

I have made an electrolytic rectifier set with four cells connected as shown on page 907 in your issue of May 11, except that I place in series with the cells six or seven 32-candlepower carbon lamps. The aluminum plates are 7 by 2 by 1/8 inch and the lead plates 7 by 4 by 1/8 inch. The battery jars are about 6 inches in diameter by 8 inches high. I use a solution of ten ounces of sodium phosphate for eight pints of water. The method of mounting the plates is shown in the accompanying diagram.—W. H. B., Norwood, Man.

No. 66.—Phantom Circuit in Telephony.—Is it good practice to use phantom circuits in telephony? If so, what are the limits of this use? What is necessary for the construction of a phantom circuit and how is it done?—N. O. M., Blacksburg, Va.

The phantom circuit has in recent years come into general use as a means of providing additional facilities without incurring the expense for material and stringing which would be involved were physical circuits alone to be considered. It also has an advantage in that a pole line carrying its full capacity of wires can be made to furnish 50 per cent more talking circuits than would be furnished were the physicals alone used. Practical conditions alone limit the use of the phantom circuit and such conditions are so varied that the use of the phantom is almost entirely dependent on local conditions. Theoretically all that is required for the creating of a phantom circuit is two physical circuits which have the same make-up and four repeating coils in addition to the ordinary subscriber's equipment. The phantom circuit in theory is shown in the diagram herewith. A repeating coil is inserted in each end of each of the two physical circuits to be phantomed. A tap is taken from the middle of the secondary side of each repeating coil. The leads from the two coils in the same office become the phantom talking leads and all that is necessary to talk over the phantom is to have talking instruments (subscriber's sets) connected to these leads. Referring to the diagram, it will be seen that a conversation can be carried on between A and A′ and also between B and B′, as the repeating coils act in the same manner as a transformer on a power circuit.



No. 66.—Scheme of Phantom Circuits.

The phantom-circuit current which originates at C or C' will divide at the repeating coil and use the physical circuit as a single conductor by which it will be transmitted to the distant end, C' or C. As each physical circuit is a closed circuit, the phantom-circuit current and the physical-circuit currents will not interfere with each other. The chief drawback to the use of the phantom circuit lies in the fact that it is more subject to "cross-talk" and inductive disturbance than a physical circuit. Any unbalance between the two physical circuits or "side-circuits," as they are called, on which the phantom is built will be evidenced by noise in the phantom itself. It is owing to these conditions that the phantom circuit did not come into general use until the development of a transposition system which took the phantom circuit into consideration. Another feature of the phantom circuit which is detrimental is the loss in transmission over the physical circuits owing to the insertion of the repeating coils. On long hauls this feature is very objectionable both from a ringing and a transmission standpoint but for comparatively short distances (not over 100 miles) the loss is not enough to counterbalance the advantage in the saving of expense nor does it materially affect the service. For very long hauls a special high-efficiency coil has been developed which will give the maximum talking efficiency.—E. C. B., Kansas City, Mo.

It is very good practice to use phantom circuits in telephony, because each circuit obtained by phantoming has but half the resistance of the circuits of which it is composed. All the large companies are planning their construction so that phantom circuits can be established. In the case of long toll lines, the cost of four phantom coils is insignificant as compared with the cost of an additional pair of wires for the desired circuit. Especially is this true when the extra circuit, if physical, requires the installation of new cross-arms. The establishment of a third circuit from two physical circuits is accomplished by connecting four phantom coils to the lines. While some companies recommend phantoming subscribers' lines, it is not good practice, and only toll lines should be phantomed. The conditions necessary for successful operation of the system are: (a) the individual wires forming a physical circuit must be of equal resistance; (b) the circuits used to make up a phantom circuit must be properly transposed to prevent cross-talk; (c) the coils must be well protected in the offices where the lines terminate, for damaged coils are hard to repair; (d) the wires forming the circuit should be of the same material and gauge.—W. C. W., Pittsburgh.

CHICAGO MEMBERS OF N. E. C. A. MEET.

Monthly Rally of Electrical Contractors.

Mr. Kreider said beforehand that this was to be "a good old experience meeting," and toward its close Ernest Freeman remarked that it might well be styled a harmony meeting. The fact is, this meeting of the Chicago members of the National Electrical Contractors' Association, on the evening of May 15, was both of these, and more. There were helpful recitals of interesting experiences in electrical contracting; many assurances of the constantly increasing spirit of harmony between electrical contractors on the one hand and electrical inspectors on the other; and also the consideration of other matters of great importance in the field of contracting and inspection. It should be mentioned, too, that the dinner served, the music furnished and the prevailing spirit of hospitality and good fellowship would have caused even a man with no interest whatsoever in electrical matters to have carried away the pleasantest sort of recollections of the occasion.

This was one of the meetings which the Chicago contractors have been holding monthly. Including the five out-of-town guests, there were about seventy present. Charles R. Kreider, president of the Chicago Electrical Contractors' Association, presided. The first speaker was C. M. Goddard, of Boston, whom Mr. Kreider introduced as the "father of the National Electrical Code."

Mr. Goddard said that he was once an electrical contractor but subsequently became an inspector, having taken up this latter work before the days of the National Electrical Code. He soon came to realize the need of uniformity of inspection rules, and applied himself to the task of setting in motion a movement to secure such uniformity. The first set of uniform rules was published in 1893, and these ultimately became the National Electrical Code.

Universal Data & Sales Book.

Mr. Goddard was followed by G. M. Sanborn, of Indianapolis, who spoke at length concerning the Universal Data & Sales Book of the National Electrical Contractors' Association. He said that this book was conceived out of necessity. It had been realized that electrical contractors had no universal price list and that the compilation of one was altogether too big an undertaking for any one contractor. Hence the National Association undertook the task, and it is now true that there is no other organization which is getting out such a volume. Mr. Sanborn explained that the resale prices which the book recommends are not obligatory. The book lists the costs and what are considered proper resale prices for all the material and appliances handled by the average electrical contractor. The cost prices are made up from the lists of the manufacturers. Each electrical manufacturer has sheets sent him from time to time to enable him to make any necessary revision in the prices of goods of his listed. In figuring the selling prices recommended to the contractor, what are considered reasonable profits are allowed. The resale price is considered to be one that can be charged to any customer having time and material work done or to a customer buying material over the counter. The book is not only a great convenience, but it tends to standardize prices. It is kept strictly up to date.

The data section is comprehensive. For example, there are a sheet of standard wiring symbols and sheets giving simple, accurate methods of computing discounts. There are also complete wire data. These data include the rules which the manufacturers of wire follow, and also the requirements on wires found in the National Code. Such matters as thickness of insulation, weight, resistance, carrying capacity, etc., are all found here. Still another sheet contains information concerning conduit work. Here is stated, for instance, the number and size of wires any given size of conduit may carry under conditions which are specified. A committee of the National Association is now revising this part of the book. It is hoped to make this section of it the standard among engineers, architects and contractors on matters relating to conduit work.

The speaker went on to say that the book also contains data on illumination and tells what the requirements as to electrical inspection in all the leading cities are. Thus a contractor in one city contemplating taking a contract in another may learn beforehand just what to look for in the way of inspection requirements and charges.

Mr. Sanborn closed his talk with some appropriate remarks concerning the value of organization, emphasizing especially the general value to the contractor of the National Electrical Contractors' Association. He pointed out that the Association has no paid officers, except the secretary, committee members all giving their time freely in the interest of the profession. He urged that members of the Association should not be content with simply paying their dues. They should attend all meetings and should assist the committees and officers of the Association by always answering promptly and fully all requests sent them for information. He was afraid that members sometimes

left unopened letters received calling for important data, which they could easily supply.

S. N. Tideman, of Chicago, discussing Mr. Sanborn's remarks, said that the Data Book should take into account in making resale prices the cost of handling materials. He did not think resale prices should be based wholly on manufacturers' estimates. Speaking along the same line, Mr. Kreider said that a contractor's selling was wholly different from that of the supply man. The contractor had to take back material unused, as a rule, while the supply man did not. Mr. Sanborn replied that the correctness of these remarks was fully appreciated. He thought that the committee in charge of the Data & Sales Book had not been able to take local conditions into account, however.

Conduit versus Knob and Tube Wiring, and Other Notes.

Continuing the discussion, Mr. Kreider suggested the advisability of including in the Universal Data and Sales Book a copy of the constitution and by-laws of the National Association, and also the rules of the National Electrical Code and list of approved fittings. He spoke also of the fact that the Code necessarily specified minimum requirements and municipal rules sometimes contain specifications additional to those found in the Code. He thought it a good plan for the contractor in ordering material of his supply dealer to state specifically that the material must meet the requirements of the Code and also those of the local inspection bureau.

F. E. Cabot, of Boston, who is the chairman of the Electrical Committee of the National Fire Protection Association, was called upon for a talk at this point. He spoke of the value of the spirit of mutuality and co-operation in the electrical industry, his remarks along this line causing considerable applause. He said that the Electrical Committee, of which he is chairman, is always glad to receive suggestions from contractors and he assured the contractors present that any complaints coming from them concerning matters of electrical inspection would always be given careful and thorough consideration. He said that the loss of life and property from the use of electricity is now relatively insignificant because the rules governing electrical construction are wisely formulated and, on the whole, conscientiously complied with. Referring to the National Code he paid a hearty tribute of appreciation of the work of C. M. Goddard in connection with the origin and development of the Code and its rules.

After commenting further upon the fact that contractors who are members of the National Association may appeal to the Electrical Committee of the National Fire Protection Association through Ernest McCleary, of Detroit, whenever they feel that they have been treated badly by electrical inspectors, Chairman Kreider then introduced Mr. McCleary to the meeting.

Mr. McCleary said that he had spoken so often to Chicago contractors that he almost felt he was one of them. He told how the electrical contractors had gained recognition from the Electrical Committee. He said that he hoped to see Illinois well represented at Denver in July and wanted Chicago to bring back from the National Convention that which she was entitled to, namely, the presidency of the National Association. Mr. Kreider, he stated, had asked him to speak on the subject "If There's Nothing Doing, What's the Use of Doing Anything?" "If the Chicago man whom I have in mind," declared Mr. McCleary, "is elected to the presidency of the National organization, there will be a great deal doing among Illinois contractors during the following 365 days."

A. M. Schoen, of Atlanta, Ga., was the next speaker called by the chair. He spoke entertainingly of some early experiences of his in making electrical inspections soon after the adoption of the Code several years ago. He also emphasized the matter of uniformly fair treatment of contractors on the part of the electrical inspectors. He said that where Code requirements are sufficient for local conditions the inspector should assume that every contractor bids on work with the intention of fulfilling these requirements and his work should be judged accordingly. He, too, pointed out that Code rules are minimum requirements.

Mr. Kreider remarked that he was glad Mr. Schoen was in favor of giving the contractor a square deal. The good contractor, he said, had nothing to fear from the inspector. It is only the man who wants to do poor work that has trouble here. When a contractor is in doubt as to how a given piece of work should be done in order to be approved, the inspector should be consulted before the work is undertaken, Mr. Kreider said. He spoke of the spirit of co-operation between inspectors and contractors, which exists in Chicago, and called attention to the fact that in the recent revision of the Chicago rules Mr. Tousley, the chief inspector of the city, called the contractors together for the consideration and discussion of prospective changes.

Mr. Tousley was then introduced to the meeting. He spoke at some length concerning conditions in Chicago. He paid the contractors in the city a high compliment, saying they were men who do excellent work. He said that years ago the city adopted the Code rules as a part of the city ordinances. Later the city drew up a set of rules of its own based on the Code, and these were incorporated in the ordinances. The rules are revised every two years. The next edition of them will be ready in about ten days.

At this juncture Mr. Kreider reminded the contractors present that after July 1, the approval of old-Code rubber-covered wire in all sizes will be discontinued in Chicago.

A reference by Mr. Kreider to the weakness of knob and tube wiring provoked considerable discussion of the relative merits of conduit construction and knob-and-tube work. Mr. Cabot argued it was proper to require conduit for all concealed wiring in the congested districts of cities. He said, however, that in the East the rural districts use electricity extensively. The houses here are built of wood, and he did not consider it necessary or fair to require the owner of one of these houses, for example, to use conduit in the installation of his wiring. F. J. Tank remarked at this point that the fact that a wooden house is very liable to be completely destroyed if it ever catches fire at all should be an argument in favor of the use of conduit in houses of this type.

Mr. Cabot's remarks concerning the possible injury to the insulation of wires in pulling them into conduit runs having short bends, and the troubles which may arise from water accumulating in conduit, led William McGuineas to say that he thought it unfair to compare a poor conduit job with a good job of knob-and-tube work.

Warren Orne stated that he was glad to hear this matter discussed, for it was one he had brought up at the last meeting of the Illinois Electrical Contractors' Association.

Ernest Freeman, being called upon by Chairman Kreider, said he was glad to see such a spirit of good fellowship among the contractors and inspectors as had been manifested at this meeting. He said further that he wanted to correct a false impression that seemed to have gone abroad. The money donated as prizes by J. N. Pierce for the best speeches on electrical contracting at the meeting of the Illinois Electrical Contractors' Association last winter was donated in good faith, with the consent of the Association, was won fairly by the contestants—*and kept.* When the merriment caused by this declaration had subsided Messrs. Kreider, Poelma and McGuineas, the winners of the prizes referred to, all declared that Pierce never got back a cent of the money, and could not have gotten it even if he had wanted it.

NOTES ON NIAGARA FALLS INDUSTRIAL DEVELOPMENT.

By Frank Koester.

Mr. Koester has been investigating the electrical developments in the vicinity of Niagara Falls for several months, and will, from time to time, present in these notes a report on some of his observations, particularly with regard to industrial applications of electrical energy.

During the last four weeks I have been making an investigation regarding the industrial situation in the vicinity of Niagara Falls and farther up into Canada. It was but natural in beginning my investigation to visit the various power plants around Niagara Falls. It may be pointed out that the commercial value of what is called the scenic beauty of Niagara Falls and Rapids is apt to be overlooked on account of the purely academic significance which is consequent to esthetic considerations. Abraham Lincoln, in some notes on a lecture on Niagara Falls, as pointed out by the American Civic Association in 1911, said that the value of the great cataract was not so much in its grandeur as in its power to excite reflection and emotion in the people who saw it. He might, had he known how travel would be stimulated, have gone further and added some statement as to its value as a cash producing asset to the people of the United States and Canada. It has been estimated that not less than 800,000 visitors annually come from a distance to admire the great falls and that the average amount spent per person is $25, resulting in a gross traveling sum for a mere sight of the falls of $20,000,000 per year. Capitalizing at five per cent this would represent a value to the American people of $400,000,000, or in other words, every person in the United States has an ownership of $4 in Niagara Falls. The value of Niagara Falls to the American people, aside from Lincoln's reason for their existence, and in simple dollars and cents, is from the layman's point of view, greater as a spectacle to attract travel than as a source of water power. But as a source of power the engineer's and business men's point of view of the value of the hydroelectric developments to advance industry and increase the general welfare of the country at large is seemingly little recognized.

It is estimated by Professor Unwin that the water flowing over the falls would generate 7,000,000 horsepower, and from an engineer's point of view, if there were a market for it, every drop should be utilized for the benefit of the country at large.

From an economic standpoint the power possibilities of Niagara Falls and river constitute today the most important hydraulic sight in the world. The process of depletion of the coal fields of the United States, especially the anthracite coal fields of Pennsylvania, will tend to cause the esthetic claims made in behalf of the scenic beauty of Niagara Falls and Rapids to yield before possible aggressive demands made by companies to utilize the water discharged from Lake Erie. It is noteworthy that many of the charters already granted for power development are kept alive even though as yet no construction work has been begun. The time is coming when the people will see that the amount of water which would naturally course the entire length of the Niagara river bed, and which may, even temporarily, be diverted for power purposes without proving to be a serious menace to nature's balancing of the levels of the Great Lakes, is much smaller than is popularly supposed.

Of the 7,000,000 horsepower which it is possible to generate at Niagara Falls, less than half of one million is being utilized today.

But even this is the greatest power development in the world and is setting an example in generation and distribution, and utilization of hydroelectric power to the profession the world over.

The Brusio Works in the southern part of Switzerland, supplying power to Italian towns, industries and farms; the Loch Leven plant in Scotland, the power of which is largely utilized in making aluminum; and the Svalgfos Works at Notodden, Norway, where thousands of horsepower are used exclusively for making air nitrate or artificial Chilean saltpeter, are the largest power plants in Europe. These with the developments of the Necaxa River in Mexico, transmitting power to the City of Mexico, 100 miles distant to the southwest and thence 70 miles further west to the El Oro mining district; the recent developments at Rio de Janeiro, Brazil; that at the Rand in South Africa, the Great Falls and other plants of the Southern Power Company of Charlotte, N. C., on the Catawba River; are the largest and most noted plants in the world, but all taken together do not represent the power that is even now developed at Niagara.

As a specialist on this subject the writer was familiar with the progress made at the falls. In his visit to the falls in 1904, the large power plants had already been in operation for many years on the American side. New and still larger developments have been made on the Canadian side.

Additional development has also been made on the American side. The earliest development on the American side is the Niagara Falls Hydraulic Manufacturing Company, which established the first plant in 1881. The Niagara Falls Power Company, which was authorized to take sufficient water to generate 200 horsepower, started its plant No. 1 in April, 1895. This plant, using the first 5,000 horsepower turbine, has set the example for future development at the Falls.

The Niagara Power & Development Company has the right to divert water from Niagara River for all purposes except for motive power in factories. The Niagara, Lockport & Ontario Power Company was empowered to take water from the Niagara River for supplying Niagara, Lockport and other cities. In 1904 it failed to secure legislation to perpetuate its privilege, and has since been operating as a transmission company. The Niagara Gorge Power Company was incorporated (1905) to generate, transmit and sell electricity in the state of New York. The Lower Niagara River Power & Water Supply Company is empowered to divert sufficient water from Niagara River to produce 200,000 horsepower. The Cataract Power & Conduit Company, controlled by the Niagara Falls Power Company, has the exclusive right in the city of Buffalo to receive, use and transmit electric power, light and heat; also to supply Niagara Falls power to the Buffalo General Electric Company and International Railway Company. The Niagara Falls Electrical Transmission Company, controlled by the Electric Development Company of Ontario, has a franchise to distribute electrical energy to certain towns in the state of New York. The following companies have been granted privileges to divert water from Niagara River on the American side, but have done no construction work as yet: Lockport Water Supply Company, Lewiston Water Supply Company, Buffalo Supply & Drainage Company. Besides the small power plant of the International Railway Company the power companies on the Canadian side are the Electric Development Company of Ontario, the Canadian Niagara Power Company, and the Ontarian Power Company of Niagara Falls. The power generated at the plants of these companies is consumed, in accordance with the Burton act, partly in the United States and partly in Canada. This will be discussed in a later issue.

Telephone Train Dispatching.

The New York, Westchester & Boston Railroad has adopted the telephone for train dispatching. The telephone cable has been laid underground.

METER PRACTICE FOR SMALL CENTRAL STATIONS.

Single-Phase Meters.

By Guy R. Grove.

There seem to be comparatively few managers of small central stations who take an active interest in the testing and maintenance of the meters on their lines. This is due partly to the opinion of a great many small-central-station managers that the cost of the maintenance of a meter department and periodic tests decreases rather than increases the net earnings of the company, as the gain through accuracy is not held by the meters for a sufficient length of time to recompense the company for the cost of the testing. Managers arguing along this line, however, do so because they have not investigated the cost of the maintenance of a meter department sufficiently to know the benefits derived from it when well managed and organized. It is safe to say that there is no company doing a live business and having from 1,000 to 5,000 meters on its line which can not show a proportionate gain in both gross and net earnings by maintaining a well managed meter department.

Every station, however small it may be, should have a meter department and a real meter man, who should devote all his time to meter work and who should be held absolutely responsible for the accuracy and maintenance of meters. By a real meter man is meant not a man who only knows how to set and to test a meter simply by making adjustments, but one who understands the whole theory of the meter and all its parts and who gives the meter problems, troubles and remedies his entire time and thought.

The number of men required in a small plant depends on the scope of work done by that department. The cost of maintenance of meters can be greatly reduced by having the meter department do all the work pertaining to meters as testing, repairing, setting and removing, and reading. If the number of meters on the line is large enough, better efficiency can be obtained by having a man especially trained for each branch of the work. If all of the work pertaining to meters is done by this department, one man for each 1,000 meters is a fair figure, if the meters are to be kept in good shape and given periodic tests.

At least one or two rooms should be set aside for testing, repairing and storing the meters. The equipment depends altogether on the number of meters to be taken care of and the class of consumers. The work room should be provided with a work bench and furnished with a vise, soldering irons, small drill press and all other necessary tools for simple repair work, and should be well lighted and absolutely free from dust, vibration and jar.

Simple repair parts, such as pivots, jewels, dial hands and parts, extra series and shunt coils, glass windows, felt washers and similar material, should be kept on hand. These parts should be kept in a cabinet provided with convenient drawers. A test board should be provided of simple but serviceable construction. The wiring of the test board should be arranged to allow an opening in the load circuit for the standards and at least two openings for meters under test so that two can be tested at one time by connecting them in series. The board should be supplied with 110-220 volts and three-phase service; and if the

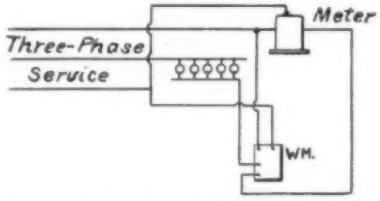


Fig. 1.—Connections For Obtaining 50 Per Cent Power-Factor.

voltage is subject to much variation, means should be provided for regulating it. A lamp bank can be used for a load and should be wired with switches in reach of the operator at the board so he can get any desired load up to 25 amperes. Above that a series or sign transformer should be used to step up the current for testing high-current meters. A series instrument transformer can then be used for stepping down the current for the five-ampere coil of the standards.

The tests can be divided into three general classes, namely, shop, periodic and complaint.

The shop tests and work, which will be considered first, consists of tests and heavy repairs on meters which cannot be done while the meters are in service.

The instruments required for a company having from 2,000 to 5,000 meters with the average number of power consumers on the line are, at least, as follows:

Three rotating standards.

One 10-ampere, 110-220-volt, indicating wattmeter.

One 5-10-ampere, indicating ammeter.

One 110-220-volt, indicating voltmeter.

One 5-10-ampere, 110-220-volt, indicating three-phase wattmeter.

Series and shunt transformers for handling currents and pressures up to 600 amperes and 2,200 volts.

The question of keeping these testing standards in accurate calibration is very important. Rotating standards, if used daily, should be checked up weekly against a high-grade indicating wattmeter. Indicating wattmeters should be handled very carefully and checked up frequently by the manufacturer or a standardizing laboratory.

In small meter departments, having but one or two rotating standards, very fair results can be obtained by checking them up with two or three new meters just from the factory. If this method is used the meters used for checking the standards should be handled carefully and used for no other purpose. Meters just received from the factory should be checked simply to ascertain if they were damaged in any way during transportation. This is not considered necessary by all companies, but is a good practice if the necessary time is available.

Meters which have been overhauled or repaired should be carefully tested as follows:

(1) At full load and unity power-factor.

(2) At one-tenth load and unity power-factor.

(3) At 5 per cent load and unity power-factor.

(4) At full load and about 50 per cent power-factor.

Unity power-factor can be obtained by using a lamp bank or other form of non-inductive resistance. 50 per cent power-factor may be obtained by loading on ordinary resistance and putting the potential coil of the meter on another phase of a three-phase circuit as shown in Fig. 1.

For other inductive loads, an induction coil, such as a set or two of five-ampere reactance coils from a multiple arc lamp, can be used in series with the resistance load.

Meters of modern types are designed to register accurately on from 4 to 5 per cent of their full load and should be so adjusted on the line and in the shop. The older types should be adjusted to register accurately on one-tenth load. The real importance of adjusting meters to register correctly on light load is not generally realized. It must be remembered that most of the meters in the residence districts are operated the greater portion of the time on from 10 to 25 per cent of their rated capacity and even less, as the introduction of the tungsten lamp may and often does bring the load down as low as 0.25 ampere, or only five per cent of the rating of a five-ampere meter.

This point of adjusting the meters to be used for residences to register

accurately on light loads is too often neglected, for an investigation will show that the chief loss caused by incorrect meter registration is on the consumer's long-hour light load.

Another important point to watch is to avoid creeping. In overhauling meters more or less dirt particles fall and lodge in the jewel, gears and other parts where friction exists and cause the meter to run slow on light load. Instead of taking the time to clean all parts thoroughly and remove the cause of slow running, the light-load adjustment is too often used to overcome this additional friction. This is a poor practice as these dirt particles very often work out or only affect the meter a portion of the time and the result is that the meter will creep at no load. Meters will also creep when subjected to unusually high voltage, vibration, or when metering its own load, which may be caused by the shunt coil being tapped on the load instead of the line terminal, by mistake in overhauling the meter. A short-circuit in the series coil of an induction meter will also cause it to creep. Of course the amount registered on the dial is not much, as the disk may have to creep from 3,000 to 6,000 revolutions to register a kilowatt-hour, but it is the cause of a great many complaints from the consumer which, of course, cost money to adjust.

Meters overhauled after being carefully calibrated in the shop, should be given an all-night running test on about one-half or three-fourths load, in order to test out the gear ratio and other defects which may not be observed during calibration. This can be conveniently done by connecting as many meters as is desirable with their load coils in series and shunt coils in parallel with a master meter. The readings of all the meters are taken in the evening and the consumption of each meter observed in the morning by comparing its reading with the reading of the master meter. This scheme is sure to show up the defects of the meter, if it has any, before it leaves the shop and insures the meters being in good shape for service. Burrs on the train gears, bent pivots, etc., often do not show up during the calibration of the meter.

Periodic Tests.

Periodic testing does not differ materially from shop tests, except that no heavy overhauling is done. With the advent of the rotating standard, one man is all that is necessary for these tests. He should be provided with a light rotating standard, load resistance, a kit of meter tools, light repair parts and a slide rule. The old method of using a standard resistance and voltmeter or an indicating instrument is not considered efficient any more as the rotating standard is more rugged and calculations are more simple and quicker.

After reaching a job the inspector should examine the wiring to see that no jumpers or other current-stealing device is used. He should then remove any dust or dirt on the meter and remove the cover and without making any adjustment, make a test on 5, 25 and 75 per cent load. If the meter is found running slow he should proceed to examine parts for dirt or other causes of undue friction.

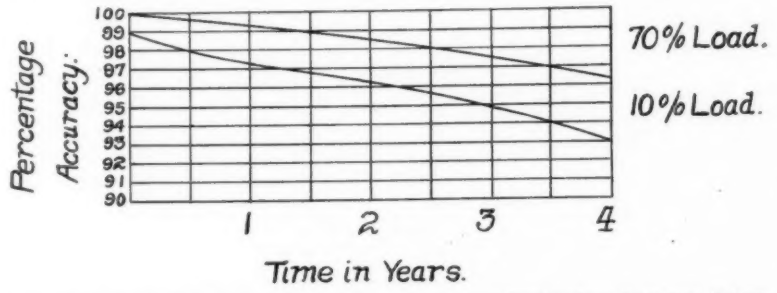


Fig. 2.—Average Decrease in Accuracy of a Group of Single-phase Induction Meters.

Before leaving the job he should see that the meter is perfectly level and is securely fastened on a wall which is not affected by vibration or jars from doors closing.

Routine testers sometimes find their work monotonous and if they find a meter in a bad position to get at to adjust and clean, they will turn in a report that the meter is O. K. To avoid this practice the meter foreman or another competent tester should occasionally follow the routine tester and check up his work. This matter is well worth giving attention.

The number of meters that a tester can check averages from 10 to 12 per day in residence districts, but of course depends on the condition, location and type of meter. For large meters a helper should be sent with the tester as better results can be obtained and considerable time saved.

The frequency of periodic tests depends on the class of meters. Meters of the induction type used in residences will hold their accuracy for a period of 18 months or two years. The head of the meter department should look over the meter readings and those showing a heavy consumption, as large residences and business places, should be checked up every year. Meters with ball bearings will withold their accuracy longer than one with a jewel bearing. Jewels should be examined with the sharp point of a pin or a magnifying glass and if they are in the least rough or cracked should be replaced with new ones. This is a better practice in judging the condition of a jewel than to consider a jewel defective after the disk has made two or three million revolutions.

Complaint Test.

The work of a tester on complaint does not differ much from the routine tester, except that he should make a more thorough test and examine all the lamps or other current-consuming devices in the house and find out if possible, how long each is used each day. He should also note if the consumer is using the proper size and type of lamps to get the best results and if he is not, he should note in his report where the consumer could use smaller lamps or ones with a higher efficiency without really affecting his needs. Such information should form part of his report to the office so it will be available when writing to the consumer or adjusting the complaint.

Many managers of small companies who are endeavoring to maintain the highest efficiency on their systems often neglect the maintenance of meters, thinking it is a very minor detail. If they give the meter situation any consideration whatever, they will have to admit that it is an instrument which contains a motor which is of the lightest and most delicate type on the market and which is required to work under all conditions, in any location and run intermittently for months without any attention whatever.

The amount of revenue lost through slow meters is difficult to determine with any great degree of accuracy. All meter tests, however, show the greatest error is on light load, which as stated before, in residence districts is the load carried by the meter the greater share of the time service is used. Therefore, it is to be expected that the loss in revenue is greatest on this load and should be given special attention.

The accuracy of a meter will decrease with the length of time it is in service. This rate at which the accuracy of a meter falls off can only be known from results secured from actual tests. The results of tests also vary, depending on type or style of meter, local conditions, type of bearing and several other items. The curve in Fig. 2 shows the average decrease in accuracy of a lot of single-phase in-

duction meters used in residences and where the annual income averages $30. These meters were on the line of a company which was more or less indifferent in regard to the accuracy of its meters and the lot in question had never been tested. They were put in service when new four years previous to the test.

As the general tendency of these meters was to run slow and the test showed an average error of 3 per cent on heavy load, 5 per cent on quarter load, and 7 per cent on light load, it is at once apparent that the company was losing a nice sum each year after the second year.

If we assume that the average error is the error on one-quarter load and that the income is $30 annually, we find that the company in the fourth year lost approximately $1.50 on each meter. As a matter of fact this company had 1,600 meters, which also averaged about the same in accuracy, making an annual loss of $2,400. The actual cost of testing these meters, including new instruments, was $1,100, which would have represented a net saving of $3,220 for the third and fourth years, if the meters had been tested at the end of the second year. In a great many cases the error was more than 5 per cent, as very few residences use one-quarter of their connected load as much as they do one-fifth or one-tenth load.

As a further example of the necessity of keeping meters properly calibrated, the results of tests on three lots of meters is shown in the following table:

TESTS ON HEAVY LOADS.

	Not	Per Cent Registration.						
Lot No.	Recording.	70 to 80	80 to 90	90 to 95	95 to 98	98 to 102	102 to 105	105 to 110	Over 110
1	11	5	13	20	14	85	23	8	3
2	..	3	1	16	23	44	1	.	.
3	1	.	1	4	20	187	2	1	.

TESTS ON LIGHT LOADS.

1	5	1	2	13	20	117	21	10	1
2	.	.	2	8	24	54	..	..	.
3	1	.	1	2	12	198	1	1	.

Lot No. 1 shows a group of 184 five-ampere old round-type Westinghouse meters installed on a 133-cycle system and three years later the system was cut over to 60 cycles. These meters were not tested or cut over to 60 cycles until two years after the change of frequency, as it was not considered necessary. The general tendency of a 133-cycle meter is to run from 8 to 10 per cent fast on a 60-cycle circuit, but these had been in service so long that the friction greatly decreased the speed of the meters, as a study of their accuracies will show.

Lot No. 2 shows a group of 88 five-ampere meters of the same type as above which had been run four years without calibration. These meters were improperly set, which had an appreciable effect on their accuracy.

Lot No. 3 shows a group of 216 General Electric type I meters which had been tested on a periodic test about 18 months previously and retained a good accuracy for that period.

An examination of the curves in Fig. 2, which show the decrease in accuracy on one-tenth and seven-tenths loads, will show the period at which the meters should be tested. It is generally assumed that when a meter is registering less than 98 per cent on heavy and 96 per cent on light load, it is time to test again. The curve shows this time to be between 18 and 24 months for this class of consumers.

Keeping the meters in proper calibration results in several important advantages among which may be mentioned:

(1) Increase in company's revenue (2) decrease in number of complaints, which are expensive to adjust; (3) gain in customers' confidence in meters and general policy of company.

Just as long as meters are built with such delicate parts, they can not be expected to keep their calibration as perfect as a quart measure or a yard stick, but the expense of keeping them registering accurately will, if in the hands of a good manager, be so far below the loss of revenue by slow meters, that it will be a paying proposition for any central-station company, besides being an important duty towards the public buying its energy.

The Prevention of Accidents.

At the recent meeting of the Birmingham (Ala.) Association of Electrical Engineers, H. M. Gassman, in his presidential address, spoke interestingly on the subject of accident prevention with special reference to the installation, maintenance and operation of electrical apparatus. He enumerated certain general principles governing the safety of employees and the public and mentioned some of the general conditions which give rise to accidents.

It is only too true that "accidents happen in the best regulated families." It is hardly possible to limit them entirely, but they may be greatly reduced by a careful study of the conditions. It is well to know "how to act" after an accident has happened, but it is a greater art to prevent its happening.

It is only natural to ask, "Why should we be interested in preventing accidents?" Briefly the answers are: First, every employer realizes sooner or later that accidents represent considerable loss in money due to the liability incurred, incapacitating skilled employees and disorganizing his business, or arousing antagonistic feeling in the public. Accidents directly affect him commercially, to say nothing of the humane side. It is obvious that if an employee co-operates with him toward reducing accidents he becomes more desirable and more highly valued.

Second, from a human point of view an employee owes it to his fellow employees and the public, as well as to himself and those dependent, to prevent accidental death and physical and mental suffering.

To the person of average intelligence, electricity is a rather mysterious thing, and there is a general feeling that everything electrical is dangerous. On the other hand, electrical accidents are often the result of disregarding natural laws applying to electricity and a failure to appreciate the risk involved. It is a well known fact the world over that when the origin of a fire cannot be positively ascertained it is attributed to the electrical wiring, where such is present. Nevertheless, the fact remains that electrical work must be considered as hazardous. It is, therefore, especially important to safeguard every one concerned, against injury. This may be in the mine, overhead, on the highway, in the mill, at the factory or the shop, in the power house or the home. The importance of this can only be fully appreciated when we recall how little is generally known regarding electricity, that a voltage as low as 50 may prove fatal, and that moving machinery is essential to generate and usually to transform electrical energy. We can see dangerous moving machinery, hear the noise that indicates trouble, feel the heat from hot bodies before we come in contact with them, but we lack an electrical sense to detect the presence of electricity by our physical organism.

Within the last decade more or less systematic work has been done in the way of minimizing accidents along industrial lines, and some legislation has been enacted in this direction. The liability departments of large insurance companies have compiled statistics of industrial accidents, the classification of which data furnishes a good basis for study of conditions giving rise to all kinds of accidents. A review of these statistics shows that there are comparatively few causes for the majority of accidents, and even fewer general principles, if applied, might materially reduce the hazard. Furthermore, an analysis of such data is valuable in showing what, on the average, does happen, and gives a good basis on which the employer can proceed to make a careful study of his own conditions and take the necessary steps to prevent such accidents being repeated within his own sphere of activity.

European countries, notably Germany, have done considerably more in the line of preventing industrial accidents than this country. They have much more stringent mining laws and

rules for covering factory installations and operation. The result is that the number and character of accidents have been greatly reduced in the last few years.

This country, however, is following Germany's lead very closely, and while our laws are not as stringent, they no doubt will be before very long.

The United States Steel Corporation was the first to make a systematic study of the problem of looking after the safety of its employees. Such a scheme, attempted on a grand scale with a large organization devoting its time solely to this purpose, will of necessity mean that a great deal will be accomplished. Superintendents of safety, and safety committees composed of officials and employees, are appointed for the express purpose of looking out for danger and safeguarding the workman. The corporation no doubt has spent considerable money in ascertaining the cause of accidents, educating the employee along the lines of safety, and installing and furnishing safety devices and apparatus of all kinds. While the Steel Corporation has done much towards preventing accidents, they find it necessary to be continually on the alert to take care of changes and conditions where new processes or methods have been introduced. The rules and instructions prepared so far, when analyzed, show that underlying them are certain general principles covering the duty of the employee to himself, his fellow employee and his employer.

To make such a campaign of safety a success it was necessary to secure the co-operation of all those concerned. One of the best ways of carrying out safety rules and precautions for preventing accidents, is to encourage suggestions from the workmen themselves in reference to safety features that are not properly taken care of. Another way is to convince the employee that in looking out for the safety of others he may be educating some one to save his life under similar conditions, and that if he is careless he imperils the safety not only of himself but of others.

Many sets of specific rules have been compiled by individuals, companies and corporations to reduce the more common type of accident to the public and to the employee. These rules, while they all work toward the same end, vary so much with local conditions that no attempt, to the best of my knowledge, has been made to collect and unify them, at least in electrical work. The underwriters have established a standard of wiring with reference to fire risk, but these do not cover any other features of safety. A similar code could not well be prepared to cover the great variety of accidents which are apt to occur in electrical work, on account of the varying local conditions, intelligence of public and employee, the equipment, nature of risk, exposure, and many other things.

The general conditions giving rise to electrical accidents are the same as for all other industrial accidents. Among these might be mentioned the following: Inevitable; lack of skill; carelessness; ignorance; absentmindedness; lack of guards; insufficient illumination; overwork; intoxicants; disregard of rules; lack of inspection; confusion of orders; misunderstanding; clothing; lack of supervision and management; absence of signals; lack of visual danger signs; lack of preparation before starting machinery; cleanliness; orderliness.

Inevitable. This covers accidents that could not be prevented and for which no one in particular can be held responsible. In general, such accidents never happen twice in the same way, and there is usually a combination of circumstances leading up to the accident which could not possibly have been foreseen. Statistics from Germany show that this class covers 42 per cent of the accidents, the remaining 58 per cent being due to negligence of employee or employer. In this country the percentage due to negligence is undoubtedly larger, and therefore the percentage of inevitable accidents is relatively smaller than in Germany.

Lack of Skill. The same report from Germany shows that 20 per cent of the industrial accidents which occur are due to lack of skill. It is therefore important that no man be put on a job unless he has had sufficient drilling or experience to make him skilled at the work. This is particularly applicable in electrical work, where men have to be drilled and trained in any particular branch of electrical work on account of the lack of suitable skilled labor.

Carelessness. It is a well known fact that familiarity breeds carelessness or overconfidence. This is a case of "knowing" and not "acting" accordingly. When carelessness becomes habitual the employee should be transferred to work where there is less or no risk.

Lack of Guards. Fully eight per cent of German industrial accidents are due to the absence of guards, and this percentage is even higher in this country. The guard may have been provided originally and not replaced by the employee when once removed. Such guards should be used to protect one from coming in contact with moving machinery, getting in the path of moving machinery, and falling into openings such as in the floors of buildings, or from walk-ways, platforms and stairs.

Insufficient Illumination. It is estimated that 25 per cent of the industrial accidents are due to insufficient illumination. This is particularly true where workmen pass from daylight to places lighted artificially. The artificial light may be sufficient for those accustomed to it, but the eye does not respond immediately to the change in light when passing from a very bright illumination to a place lighted at low intensity. It is therefore important that lamps be placed along walk-ways and thoroughfares rather than distributed uniformly over the whole floor.

Overwork. Fatigue leads to carelessness and long hours without rest are responsible for many accidents. The physical is so closely related to the mental that fatigue of one affects the other.

Disregard of Rules. This closely borders on carelessness, but differs from it by being a willful violation of rules, and covers such things as deeds of daring or boasting, unnecessary exposure to danger, of taking short cuts for completing a job instead of doing it the safest way, or trespassing in forbidden dangerous locations. Rules should not be made unless they will be enforced. They should be put up in such shape and so distributed that there can be no excuse for the employee not being familiar with them.

Lack of Inspection. Machinery and apparatus deteriorates and gets out of adjustment naturally, and many accidents can be prevented by a rigid, methodical and regular inspection sufficiently frequent to suit the conditions and the apparatus. Whenever unsafe conditions or defects in the machinery or apparatus are discovered the apparatus should not be continued in service, without orders from a superior, until repairs or adjustments can be made.

Following are a few important rules applying to the electrical workers; which rules, if observed, will reduce very much the risk of handling circuits of dangerous voltage, or of operating electrical machinery of any kind in any place.

No inspection, repairs or changes of cables, wire or apparatus should be conducted by any one except those authorized.

No temporary work should be permitted unless it is good and safe enough mechanically and electrically to be permanent.

Only skilled and experienced workmen should be employed on hazardous jobs. Such work must be performed under the direction of a competent man at all times.

When instructions are not complete, or not thoroughly understood, consult your superior and follow his directions.

Do not handle circuits promiscuous-

ly and do not get the idea that you are expert at it. Overconfidence breeds carelessness and accidents are the result. Competent men are cautious, only unskilled and inexperienced men take chances.

Avoid working on live circuits except where absolutely necessary, then take all necessary precaution to insulate yourself thoroughly from the ground and the neighboring wires of opposite polarity, using such means as are provided or as are proper for the risk involved.

Before mounting, examine carefully all poles, brackets, cross arms, etc., to see that they are safe. Do not work on defective poles unless they are properly guyed.

Inspect carefully all guy wires, anchorages, poles, towers and brackets before putting up wire and straining.

Inspect all apparatus and tools used; if same are found defective discard them or have them repaired.

When handling wires of low voltage, such as for telephones and for signals, use the same precautions as in handling other wires with which they may become crossed. It is not safe to depend upon the insulation on the electric wires to protect you against shock. Insulation deteriorates with age and especially when exposed to weather or the action of water in mines.

When working on live circuits use one hand at a time and keep the other behind the back. Shocks from hand to hand are the most dangerous.

Insulation on tools and rubber gloves are good things if they are ample for the voltages to be handled, but they are apt to prove a delusion as they cannot be depended upon being in good condition and satisfactory for the purpose.

Linemen must always use safety belts when working overhead.

Use the same precaution when working on circuits of low voltage as higher voltages, for the reason that they may be crossed with circuits of higher voltages, and it is good training for you when you must work with higher voltages.

Avoid working on circuits running overhead or on lightning arresters while there is any sign of lightning.

Never depend entirely upon tracing out circuits, rather test them out with lamp, magneto, voltmeter or other means.

When working on a dead circuit that might be made alive, treat it as alive.

Where circuits are controlled only from the power house, written instructions should be given to the man in charge of the power to open and close such switches as control the circuits on which work is to be done. The operator must place a tag on the switch, calling attention to danger of closing same before the work is finished. Before this switch is closed see that everything is in the clear and everybody has been notified to keep away from the circuit.

It is the safest plan to short-circuit the circuit that has been made dead before working on it.

Switches and wires of high voltage should be placed out of ordinary reach. Where this cannot be done they must be properly guarded to prevent persons coming in contact with them.

Apparatus carrying over 250 volts must have its frame or case thoroughly grounded.

All wires must be supported securely on suitable insulators.

Insulated platforms should be installed around apparatus of high voltages that is apt to be touched by the operator or other employees.

Lamps on circuits of 220 volts and higher should not be trimmed without using a suitable insulating platform to stand on.

When working on wires underground, special precautions must be taken on account of the dampness and the fact that grounded circuits are used in such places.

Trust Decisions Discussed by Professor Jenks at Boston Electrical Luncheon.

J. W. Jenks, of Cornell University, Ithaca, N. Y., spoke to a large and enthusiastic audience of electrical men on May 10 at the American House, Boston, on "Recent Trust Decisions and Their Economic Aspects." The occasion was the usual weekly meeting of the Luncheon Club branch of the New England Section of the National Electric Light Association. Chairman Louis D. Gibbs of the Boston Edison Company presided, and in introducing the speaker pointed out his world-wide reputation as an economist. The remarks of the speaker were followed with the greatest interest and many of those in attendance remained to express their appreciation.

Professor Jenks stated, in opening, that the decisions in the cases of the Standard Oil Company and the American Tobacco Company mark two steps in advance: Restraints of trade are forbidden by the Sherman Anti-Trust law only when they are unreasonable. The court emphasizes the need of adjusting the law to changing business conditions, either by statute, or in certain events by court decisions.

The court assumed along economic lines, (1) That under all circumstances to monopolize even partially, or to intend to monopolize must be injurious to the public interest. (2) That competition in trade unless "unfair" and carried on with the intent to monopolize is always in the "public interest." (3) That the best remedy for injurious monopoly is to so reorganize the great monopolistic corporations as to promote competition. Also that if the great corporation is broken up into a number of small ones, even though the ownership of the stock in the small ones remains in the same hands, it will secure competition. Anything that tends to bring about a higher standard of living for the masses of the people is in the public interest

It has been clearly established repeatedly that the great industrial combinations do save industrial energy and make great savings in freight, in advertising, in salesmen, and in many other ways. These savings of combinations make monopoly possible.

Fierce competition sometimes injures the public. It is not in the interest of the public that business be carried on without a living profit by companies which have great sums of actual capital invested. Competition has sometimes prevented this.

The great corporations have sometimes ruined competitors, but no more often than does the competitive system. The effect of combination on prices has been sometimes to raise them, sometimes to lower them, sometimes to steady them. It does not seem probable that on the whole the great combinations have on the average increased prices to the consumer. Neither does it appear that as a matter of fact that they have lowered average wages nor does it appear that they have on the whole crushed out individual initiative in their employees.

The decisions of the Supreme Court do not seem to have succeeded in forcing the combinations to return to the competitive system. If these separate corporations divide territory, make price agreements, or in any other way make the savings effected by the combination themselves, competition is not reestablished. The values of the stocks have increased, and other indications seem to show that the decisions failed to work. Such a result might well have been anticipated.

If the combinations injure competitors by unfair methods of competition, or the public by increase of prices, or the wage-earner by undue pressure, they should be controlled. Dividing them up into separate organizations which cannot make savings is clearly in opposition to the economic progress of the people. These court decisions, then, from the economic view-point, are not wise. If the court felt constrained by the letter of the law to make these economically unwise decisions, Congress should immediately amend the law so as to make such unwise decisions unnecessary. If it is possible for the court to avoid this economic injury by some other form of decision, it should render its decisions in such other form by its interpretation of the present law.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

Schenectady Meeting, May 17.

The 273rd meeting of the American Institute of Electrical Engineers was in the nature of a one-day convention held at the Mohawk Golf Club, Schenectady, N. Y., on May 17. The meeting was an exceptionally successful one, 400 members and guests being present. Only two technical sessions were held, one in the morning and one in the evening. The afternoon was devoted to social affairs, inspection trips and athletics. Among these features was a buffet luncheon, a prize golf game, baseball game, inspections of the works of the General Electric Company, American Locomotive Works and the electrically operated waterworks of the city, a Dutch dinner at 6 p. m., and finally a smoker after the evening technical session.

Group at Schenectady Meeting, American Institute of Electrical Engineers.

The morning session was opened by Chairman E. B. Merrian of the Schenectady Section. He introduced the Mayor of Schenectady who welcomed the members to the city. The welcome address was responded to by Dr. Steinmetz. President Gano Dunn then took the chair and opened the technical business of the meeting. Owing to the fact that the program called for the reading of ten papers at only two sessions it was necessary to present all of the papers in abstract. A group of six papers was presented successfully in this manner and discussed together.

The first paper presented was entitled "Compression-Chamber Lightning Arrester," by E. E. F. Creighton and F. R. Shavor. Mr. Shavor abstracted the paper. A paper by E. E. F. Creighton, H. E. Nichols and P. E. Hosegood on the subject "Multi-Recorder for Lightning Phenomena and Switching," was presented by Mr Nichols. A third paper was entitled "Studies of Protection and Protective Apparatus for Electric Railways," by E. E. F. Creighton, F. R. Shavor and R. P. Clark. This paper was abstracted by Mr. Clark. A paper on "Propagation of Impulses on a Transmission Line," by J. H. Cunningham and C. M. Davis was abstracted by the latter. "Some Mechanical Considerations of Transmission Systems," was the title of a paper presented by T. A. Worcester. The final paper of the group was that entitled "Electrical Characteristics of Suspension Insulators," by F. W. Peek, Jr.

Compression-Chamber Lightning Arrester.

This paper describes a new form of the multigap arrester which is designed entirely to secure a low-cost protective device suitable particularly for guarding pole-type transformers. The arrester consists of a porcelain tube, within the upper portion of which is a resistance rod. Directly beneath this rod is a series of spark gaps, each of which is sealed in a porcelain bushing; these gaps are all in series. Around the porcelain tube and rising to a height nearly equal to the height of the pile of spark gaps is a U-shaped antenna, the center point of which is connected to ground. These arresters have been built in one form for 2,300-volt circuits. They are also made for high potentials. The paper discusses the considerations that led to the design of each of the parts of the arrester and describes tests made with it, and also gives recommendations as to the proper method of installing the arrester. It is suggested that one arrester be provided for each transformer and that it be mounted on the same pole as the transformer.

Multi-Recorder for Lightning Phenomena and Switching.

The first part of this paper is a dissertation on the subject of human accuracy, particularly as related to the operation of electrical equipment in times of emergency. The importance is pointed out of having a check on the reliability of substation operators, motormen and others in responsible charge of electrical apparatus who may be confronted by danger. The multi-recorder which is described in the paper has been found suitable for this purpose, although designed primarily to provide a convenient recording device for showing the exact time that switching operations, lightning disturbances, arcing grounds, and in fact any phenomena, mechanical or electrical, that can be used to close an electrical contact, have occurred. The instrument as developed can record such operations within a fraction of a second, showing exactly the day, hour, minute and second when the circuit was closed and opened. Observations can be made from a large number of points with one instrument centrally located. Two types of the instrument have been developed. In one, pencils are used to mark a line which takes a right-angle turn when a switch operation has been performed; the exact instant that this has taken place is marked and then the instrument continues to mark a straight line again until the reverse operation is performed, this being again indicated by a line at right angles in the opposite direction. In the other type of instrument printing wheels are used and these designate by the letters R and G when the circuit has been closed or opened, corresponding to the ordinary colors of pilot lamps as used with switches.

Protective Apparatus for Electric Railways.

The first part of this paper describes the effects of high-frequency discharges, such as lightning, on car wiring and points out that care must be exercised to minimize dangerous potential strains due to carelessness in this respect. The second part of the paper describes the experience with aluminum-type arresters used on the cars of the Denver City Tramway Company, where these arresters have been very successfully employed, and have practically eliminated

lightning disturbances. The third part describes the vacuum gap and charging gap, which are additional safeguards that can conveniently be applied to aluminum arresters for this service. In conclusion, the paper gives a series of experiments on the extinguishment of direct-current arcs and the changes brought about by a redesign of the old magnetic-blowout type of arrester.

Propagation of Impulses.

The paper by Messrs. Cunningham and Davis gives the results of a series of tests made on an artificial transmission line which was equivalent to one wire 128 miles long. Tests were made with the line open-circuited at the end and also short-circuited. Oscillographic records were obtained and are reproduced in the paper. The conclusions from the tests show that the ordinary equation which divides the oscillatory from the gradual transients in the circuit containing massed resistance, inductance and capacity does not apply to a line circuit with distributed resistance and capacity. In the latter oscillatory and nonoscillatory transients can occur. A transient propagation of energy can occur without oscillation, that is a case of pure traveling wave. In the other extreme, stationary oscillation can occur without propagation. This is familiarly known as the standing wave in which energy surges between the magnetic and electrostatic fields.

Mechanical Consideration of Transmission Systems.

Mr. Worcester's paper is a study of a number of mechanical details of great importance in the construction of steel tower lines. He discusses the factors that govern the selection of length of span and the influence of ice and wind both upon the conductors themselves and on the towers. The most serious stresses which a tower is called upon to withstand are those due to the breaking of conductors. Although this is by no means common, it does sometimes occur, and occasionally has been traced to the kinking of the line wires during erection. More care must be given to the subject of tower foundations since upon them falls the duty of preventing overturning of the tower. It is customary to use a factor of safety of 2, 2.5 or 3 for the intermediate towers and 3 or 3.5 for the strain towers. For the wires themselves a factor of safety of 2 is sufficient, except for excessive spans and important crossings. In conclusion, the author points out the value of using flexible towers in many cases.

Characteristics of Suspension Insulator.

In this paper Mr. Peek points out, as the results of some tests conducted by him, that the suspension insulator sometimes has a higher arc-over capacity when entirely wet with misty and penetrating rain than it has when dry. This is particularly true where the number of insulators in the string exceeds eight or nine. The kilovolts per insulator seems to be almost constant in a rain of this character; whereas, in the dry tests the addition of a considerable number of insulators does not give so high a value in kilovolts per insulator as when only a few are used. This leads to the conclusion that the greatest voltage strain comes upon the insulator nearest to the line and that the stress upon the others diminishes as they are more and more distant from the conductor. When the insulators are thoroughly wet the strain is quite uniformly distributed over the entire set. The author considers this subject also from an analytical standpoint, and shows that the calculated results agree quite closely with actual test results. Among the conclusions is the suggestion that grading of insulators may be necessary.

The discussion on this interesting group of papers was opened by E. M. Hewlett, who called attention to the great increase in radius of power distribution that has resulted from the use of the suspension insulator. These are giving excellent service now, not only at 110,000 volts but even on the 140,000-volt system recently put into operation in Michigan. The step to 110,000 volts was made with less line trouble than the previous increases that had been made with the pin-type insulator. The factor of safety with the suspension insulator has been materially increased and lightning troubles are decreased.

Paul M. Lincoln discussed what takes place when an insulator becomes wet and why a wet string of insulators may stand a higher potential than a dry set. He believed that insulator design for long strings could be very much improved by making the static capacity of those insulators nearest to the conductor higher than those which are near the tower. He also discussed a method of reducing static strains on insulators. As regards the use of flexible towers he felt that the overhead ground wire has a double value in a flexible-tower system. First, it is a protection against lightning and, secondly, it has an important bearing upon the mechanical strains along the line when a conductor breaks.

R. J. McClelland said that by taking into consideration the ground wire in connection with a flexible-tower system the weight and cost of the tower construction is materially reduced. He felt that with the suspension insulator a breaking of one of the conductors causes the string of insulators to swing to one side and introduce perhaps two feet of slack, which reduces the strain on the adjoining span materially.

C. Edward Magnusson referred to some tests that had been made by Professor McNaughton, of McGill University. These tests on string insulators check very closely those that had been presented by Mr. Peek.

James P. Jackson spoke of the non-arcing gaps in the compression chamber arrester as giving rise, in his opinion, to the probability of a continuous arc. He discussed the protection of railway motors against lightning, and felt that the electrolytic arrester is unquestionably the most effective one for protecting equipment of that character. He wondered, however, whether they receive the care that they require. He also called attention to the undisputed fact that insulators on a tower line, when all wet and leaking slightly, make good lightning arresters. A type of insulator should be developed whose action would be the same wet or dry.

Charles P. Steinmetz discussed the potential distribution in a circuit containing distributed capacity, in the one case as distributed series capacity and the other as distributed shunted capacity. In the compression-chamber lightning arrester there is the series capacity between adjacent disks and the shunted capacity between each disk to ground. In the string-suspension insulator there is the capacity of each insulator and also the capacity from the connection between adjoining insulators to ground. In such a system the potential distribution is not uniform. In the suspension insulator the problem is to get as uniform potential distribution as possible; in the compression lightning arrester the problem is to get as non-uniform potential distribution as possible, that is to concentrate as much potential as possible across the first condenser so as to be able to use as many condensers in series as possible with the same breakdown voltage and to get the arc-rupturing effect of a large number of gaps in series.

Charles F. Scott commended the entire group of papers as an admirable combination of theory and mathematics, of manufacturing and engineering design, operating conditions and of looking forward to the future for new and larger work.

R. P. Clark, concluding the discussion on his paper, said that improvements in the design of the direct-current aluminum lighting arrester have practically overcome the difficulties experienced with it when it was first brought out.

T. A. Worcester agreed with Messrs. Lincoln and McClelland respecting the value of the ground wire as an aid in strengthening transmission towers. He thought that it would not be well to allow much for the extra length thrown into a conductor by the length of the suspension insulators when a wire breaks.

F. W. Peek, Jr., agreed with Mr. Lincoln that the thickness of the porcelain in the insulator may sometimes be decreased with an increase in the strength of the insulator. Respecting the effect of the conductivity of the water on the balancing of the potential stresses in a string of insulators he thought that the leakage current through the water is generally very large compared with the capacity current.

At the close of the discussion on the group of papers, a paper on "Frequency" written by D. B. Rushmore was presented in abstract by E. A. Lof.

Frequency.

Mr. Rushmore's paper is a candid discussion of the relative merits of the two frequencies, 25 and 60 cycles, now

standard for American commercial power and lighting systems. He considers the subject in relation to the different classes of apparatus. In generators, the 25-cycle machines are somewhat more efficient but more costly than 60-cycle generators. Transformers for 25 cycles have poorer regulation and are more costly than 60-cycle units. For transmission lines the lower frequency gives better regulation and both the reactance and capacity current vary as the frequency; this is also true of the corona loss. The 25-cycle induction motor has higher power-factor, starting torque and maximum torque than the 60-cycle machine, but its weight and cost are greater for all but small sizes. Improvements in design have made 60-cycle rotary converters possible, but the 25-cycle machines are still more reliable as to commutation; they are also more efficient and somewhat lower in cost, as regards large machines. For railway purposes, whether single phase, three phase, or direct current derived from rotary converters, the 25-cycle system is so much better than the 60-cycle system that practically no installations of the latter are in use. For switching purposes the lower frequency is preferable, but for lighting 60 cycles is better, both for arc and incandescent lamps. Therefore, if the lighting load predominates, 60 cycles should be adopted, whereas, if the power load is the greater, 25 cycles should be used in connection with frequency changers for any important lighting circuits.

The discussion of this paper was opened by Samuel Sheldon who called attention particularly to the great value of the curves that were embodied in the paper.

John J. Frank discussed the subject as a designing engineer on transformers. He knew that frequency had a very serious effect on the design and operation of this apparatus. The efficiency of 25-cycle transformers is a fraction of one per cent less than that of the 60-cycle units, while the cost is 20 to 30 per cent greater.

B. G. Lamme reviewed the subject of frequency from the historical standpoint and showed how in the infancy of the alternating-current developments the various frequencies that were standard at different times came to be adopted. In Europe there is much greater variety of frequencies in use, although the standardization now is toward 50 and 25 cycles. For transmission purposes involving the use of rotary converters at substations 25 cycles seemed to be the only practicable frequency. Although after several years a 60-cycle converter had been brought out, it had rather poor operating characteristics and it was not until the construction of this machine was very materially improved that 60-cycle rotaries were regarded as practicable machines. Now, however, they have been developed to be very reliable apparatus. For general purposes he felt that 60 cycles was undoubtedly the better frequency.

G. H. Stickney communicated a discussion relative to the influence of frequency on the operation of incandescent and arc lamps. Many influences affect the observation of flicker. By inclosing lamps in translucent globes or shades the flicker is rendered practically imperceptible.

W. J. Foster compared the two standard frequencies as regards the design of generators. The 25-cycle type has the advantage in very low-speed and small-capacity machines. For generators that are both high speed and of large capacity, such as turbogenerators, there is a decided advantage in the use of the higher frequency as it permits more advantageous speeds for steam-turbine operation. There are a number of advantages that 50 cycles possesses over 60 cycles, however.

H. R. Summerhayes said that the general tendency towards consolidation of utilities has brought about great extension of the 60-cycle system. For large systems the 25-cycle frequency was inaugurated on account of the advantageous use of synchronous converters, the lower capacity of the transmission line and the decrease of reactance. However, it is considered now that greater reactance is an advantage instead of a disadvantage. Therefore, he felt that the higher frequency will come into more and more general use, and that the lower frequency will be used only for special applications.

Charles F. Scott declared that the debate relative to 25 versus 60 cycles reminded him of the old controversy between direct current and alternating current, and he felt that the answer must be as it was in that case that each system has decided advantages for particular service, consequently each case must be settled by taking into consideration the character of the load and a large number of other elements which will determine what frequency is preferable.

N. J. Neall said he has found that diffusing globes and reflectors when used in connection with modern lamps have reduced the flicker effects at 25 cycles to a negligible quantity. Aside from arc lamps practically all lighting can be done just as effectively at 25 cycles as with 60 cycles.

J. R. Werth stated that in 25-cycle systems it was frequently advantageous to provide reactance. By using 60 cycles, which system itself has a sufficiently high reactance, this difficulty is overcome.

Mr. Lof briefly closed the discussion of Mr. Rushmore's paper by explaining some of the curves. This closed the session.

The evening session was opened by the presentation of a paper entitled "Ozone, Its Properties and Commercial Production," by Milton W. Franklin.

Ozone.

Professor Franklin's paper is devoted chiefly to a discussion of ozone generators. Of the three methods for generating ozone, the electrostatic is the only practicable one. It is extensively used in various forms of commercial ozonators. The author describes the early form of ozonator of Berthelot, the Siemens & Halske type, the Gerard ozonator, the De Frise machine and that of Oto. It has been found that the absence of a solid dielectric between the electrodes favors the protection of nitrogen oxides, which give a very unpleasant odor to the ozone produced. The General Electric ozonator is then described. This consists of a series of aluminum cylinders forming the inner electrode of the ozonator and placed inside a glass tube about which is a metal coating that forms the outer electrode. The air passes between the inner electrodes and the glass tube. This type of machine renders the production of ozone possible at low voltages.

This paper was discussed by Matthew O. Troy, C. E. Skinner, J. L. Woodbridge and W. L. R. Emmet.

A paper by C. E. Eveleth on "Some Impressions of the Electric Traction Situation in Europe" was next presented.

Electric Traction in Europe.

Mr. Eveleth's paper is a review of developments in the old country, particularly as related to the electrified systems of trunk railways. He pointed out the great variety of equipment and relative lack of standardization that is prevalent. An important feature in Europe is the general movement to put storage batteries into practically all substations.

The discussion was opened by B. J. Lamme, who called attention to the relatively small draw-bar pulls used in European electric locomotives. Most of the locomotive development that one has heard of so much in Europe has been experimental and, aside from one type of locomotive used in the Simplon Tunnel, most of the machines were of greatly varying type and were evidently being tried out to see how they would operate. There prevails a tendency to introduce too many fads in the railway apparatus, thus bringing about much complication.

E. F. W. Alexanderson told of a number of observations he had made in a recent trip to Europe. The number of types of locomotives in use there is rapidly changing and there is a tendency to utilize those types favored here.

Charles F. Scott also referred to some observations he had made a year or two ago and compared these with the present extension of the New Haven road.

W. B. Potter said that European development has been burdened with a complication of ideas.

The final paper of the meeting was that entitled "Freight-Train Tests on an Electric Interurban Railway," by S. T. Dodd.

Electric Freight-Train Testing.

Mr. Dodd's paper gives the results of a series of tests made upon electric locomotives pulling freight trains on the Fort Dodge, Des Moines & Southern Railway. The electrified part of this line is about 120 miles long and is operated at 1,200 volts direct current. Among the tests made were determinations of train friction, curve and grade resistance, power consumption and acceleration.

This paper was very briefly discussed by Professor Scott.

This concluded the technical session.

New Electrical and Mechanical Appliances

Synchronous Booster-Converters for Securing Variable Direct-Current Voltage from Alternating-Current Sources.

The ratio between the alternating-current and direct-current voltages of a given elementary rotary converter is nearly a fixed quantity which remains constant, within a very few per cent, from no load to full load. Some addition to the ordinary converter or some auxiliary apparatus is necessary to obtain a variable direct-current voltage. The important commercial methods of obtaining the latter are:

1. With an alternating-current synchronous booster.
2. With an alternating-current potential regulator or regulating transformer.

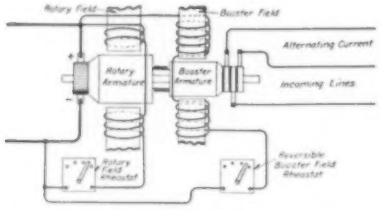


Fig. 1.—Diagrammatic Scheme of Booster-Converter.

3. With a direct-current booster.
4. With a split-pole converter.
5. By automatic compounding.

All of these methods have been applied with more or less success. The synchronous-booster method is now being advocated by the Westinghouse Electric & Manufacturing Company for certain applications, and is being used so extensively that an explanation of the principles and of the construction of the synchronous booster-converter is of timely interest. Although the booster-converter has been on the market for a relatively short time, there are already in operation 55 Westinghouse machines of this type, aggregating in capacity 70,000 kilowatts.

A synchronous booster-converter consists, as shown diagramatically in Fig. 1, of a rotary converter having on its shaft the armature of an alternating-current generator, which has the same number of field poles as the converter. It is really an alternating-current booster combined with a rotary converter. The generator armature windings are connected in series with the taps between the collector rings and the converter-armature winding.

By varying the field excitation of this alternating-current generator, the alternating-current voltage impressed on the rotary converter proper can be increased or decreased as desired. The direct-current voltage delivered by the converter is thereby varied accordingly. The principle of operation of the booster-converter is, therefore, very simple and easily understood. The machine is simply a combination of two standard and thoroughly tried-out pieces of electrical apparatus.

By means of a reversing switch in the field circuit, the polarity may be reversed without opening the booster-field circuit and the generated voltage made to increase or decrease the voltage impressed at the collector rings. The alternating-current voltage applied to the converter-armature winding may be varied, therefore, over a range equal to twice the voltage range of the direct-connected generator, and the direct-current voltage delivered by the converter varies in proportion. The converter-field current must be varied as the alternating-current voltage applied varies, in order to maintain a 100-per-cent power-factor input.

While the normal voltage for a converter of this type is midway between the extremes of its range, i. e., the voltage developed by the converter when the booster field is not excited, the fact that it may be operated over a considerable range of voltage makes it in general a somewhat larger machine than the simple converter. This increase in size is necessary to prevent excessive saturation of the iron at the maximum voltage and so that the commutation will be good at the minimum voltage.

The inherent construction of the booster, which involves a narrow multiple-path armature, is ideal for a low-voltage generator. Due to the fact that this generator is mounted on the shaft between the collector rings and the rotary-converter armature, the desired result is attained with a minimum increase of weight, space and cost.

Any standard Westinghouse rotary converter can be used as part of the combined booster-converter unit. Synchronous booster-converters can, therefore, be provided of any standard capacity, phase, voltage or frequency. They are usually furnished, however, for 250-volt, six-phase circuits.

The voltage variation can be made anything desired, by properly proportioning the boosting-generator capacity. For extreme voltage ranges special rotary converters are required. The usual variation is a total range of 30 per cent, that is, 15 per cent below and 15 per cent above the average voltage for which the rotary converter is designed. This range is obtained by a boosting generator with a capacity of 15 per cent of that of the rotary converter.

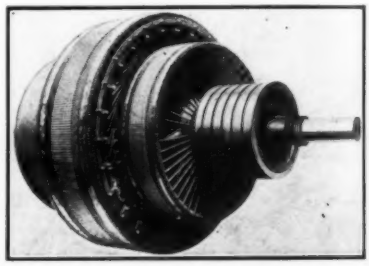


Fig. 2.—Armature of Booster-Converter.

Compared with the transformer or induction-regulator method, the booster method has the following advantages:

1. There is one unit only which requires minimum floor space and cable connections. This simplifies installation because there are no connections to make between several pieces of apparatus.

2. Rugged operating characteristics. With induction regulators dangerous forces may be developed between the stator and the rotor if the converter is connected to the alternating-current line while out of step. There have been cases where such connections have damaged the induction regulator.

Compared with the so-called regulating-pole or split-pole converter, the synchronous booster-converter has the following advantages:

1. Higher efficiency, particularly at the lower voltages.

2. Better commutation, particularly at the maximum voltages and maximum load, when good commutation characteristics are especially essential.

This advantage is further increased by the possibility of using commutating poles whenever large capacity or other conditions make commutating poles advantageous.

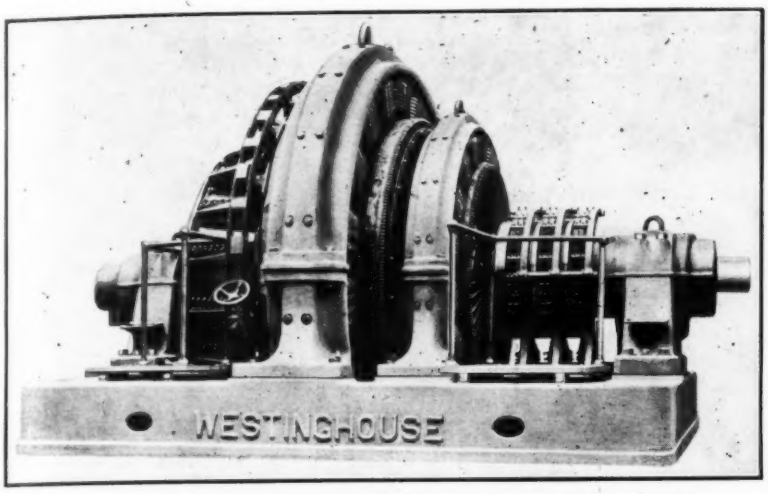


Fig. 3.—Large Booster-Converter with Separate Field Frame for Booster.

3. Smaller weight and floor space requirements, particularly for 60-cycle units.

A revolving-armature booster is used by the Westinghouse company in preference to a revolving-field booster to obtain the following advantages:

1. A compact two-bearing unit which requires minimum floor space and minimum current-collecting parts. A revolving-field generator would have to be mounted outside of the collector-end bearing of the rotary converter, and in units of the capacities for which booster-converters are used a third outboard bearing would thus be necessary. The revolving field booster also requires collector rings for its field winding in addition to the regular collector rings for the rotary converter.

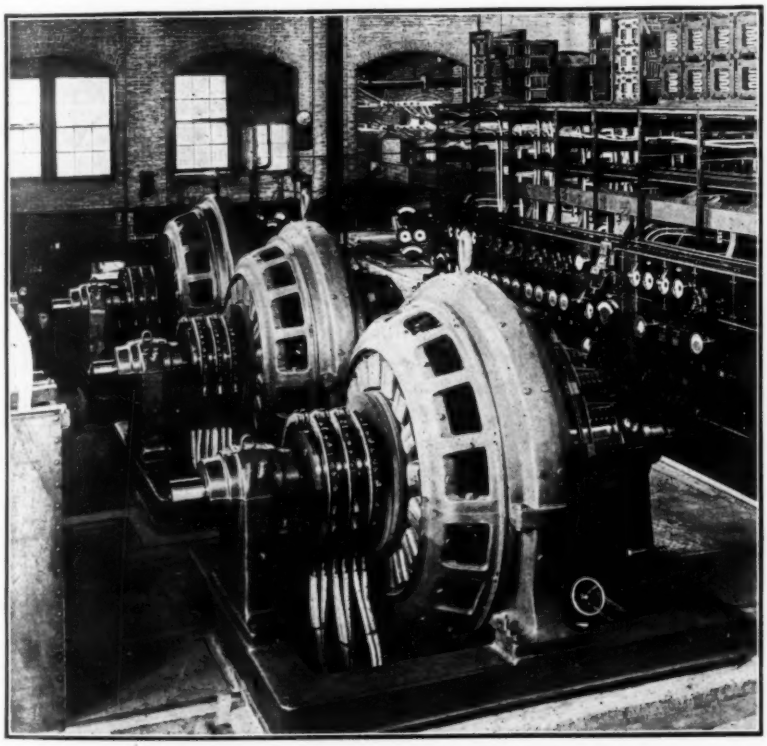


Fig. 4.—Booster Converters in Baltimore Copper Plant.

2. The electrical circuit between the booster-armature winding and the rotary-converter-armature winding consists of a number of relatively small conductors in parallel. This desirable arrangement is possible because the connections are made between points in the booster and the rotary-armature windings and are made after the latter winding divides into as many parallel circuits as there are pairs of poles. With the revolving-field booster, the leads from the converter armature to the booster armature must be cut in before the division of the converter armature conductors into armature circuits. The connections must, therefore, consist of bulky and awkward cables.

3. The connections between the booster and rotary-converter armatures are permanently made, and it is impossible to connect them together incorrectly.

Synchronous booster-converters are well adapted for any application for which a relatively wide variation, either automatic or non-automatic, in direct-current voltage is required. They are particularly desirable for serving incandescent-lighting systems where considerable voltage variation is necessary for the compensation of drop in long feeders, for operation in parallel with storage batteries, and for electrolytic work where extreme variations in voltage are imperative because of changes in the resistance of the electrolytic cells. For three-wire service synchronous booster-converters can be used in the same way as are standard converters.

Starting may be effected by any of the methods applicable to ordinary rotary converters, viz., alternating-current or direct-current self-starting or motor starting. The alternating-current, self-starting method is standard with the Westinghouse company.

Since the synchronous booster-converter is simply the combination of a standard rotary converter and an alternating-current generator of a standard form, there are incorporated in it no details of construction essentially different from those encountered in apparatus of these two classes. The only novelty is in their combination. The booster-field frame may be supported either from the rotary-converter frame (Fig. 4), as in smaller units, or from the bedplate (Fig. 3), as in the larger ones. A booster-converter can be built, if necessary, with a vertical shaft to satisfy special floor-space and headroom requirements.

A typical industrial application is illustrated in Fig. 4, which is an interior view of the converting plant of the Baltimore Copper Smelting & Rolling Company. Each of the three 1,215-kilowatt, 250-volt, synchronous booster-converters was built by the Westinghouse company, and the three units furnish direct-current energy for the entire plant. The machines have been

in operation for over two years, and were so satisfactory that when additional capacity was required, a fourth duplicate unit was installed. The voltage-variation range is 15 per cent above and 15 per cent below normal. Energy for the converters is furnished by the local central-station company.

The installation of the New York Edison Company in Gimbel Brothers' store, Herald Square, New York City, illustrates a typical application of Westinghouse booster-converters for lighting service. Each of these four machines is of 1,000-kilowatt capacity, and the direct-current voltage range is from 230 to 310 volts, or in percentages, it is a 15-per-cent "buck" to a 15-per-cent "boost." The converters feed a three-wire system, and the three-wire voltages are obtained through the use of a motor-generator balancer across the two outside wires of the three-wire system. The neutral wire is taken from between motor and generator.

Lehigh Valley Installs More Telephone Dispatching Apparatus.

With the installation of the additional apparatus recently ordered from the Western Electric Company, the Lehigh Valley Railroad will have equipped all except about 150 miles of its entire system, including main lines and branches, with telephones for train dispatching. A further extension is now being planned.

The division to be equipped is the Elmira and Camden branch, extending over approximately 140 miles of road, wholly within New York State. The dispatcher is to be located in the middle of the line at Cortland, N. Y., and will handle both dispatching circuits. So that two calls may be placed simultaneously on either end of the line, individual calling apparatus is to be used for each circuit. Thirty-five way stations are to be equipped.

A feature of the Lehigh Valley's circuits is an automatic switching or interconnecting arrangement which enables the dispatcher on any one division to communicate with the dispatcher on another. This furnishes a means of obtaining information about trains on other divisions before they arrive at division terminals.

Will Teach Wireless in Schools.

With the approval of Mrs. Ella Flagg Young, superintendent of Chicago schools, the School Management Committee has adopted a recommendation urging the teaching of wireless telegraphy in the public schools.

The *Titanic* disaster, it is said, has caused hundreds of boys in city high schools to petition for instruction in wireless telegraphy.

A New Ornamental Street-Lighting Standard.

The George Cutter Company, South Bend, Ind., is placing on the market an ornamental street-lighting standard of a new design, shown in the accompanying illustration, which the company states will meet every requisite of scientific illumination and which will comply with every requirement of ornamentation and good taste.

New Ornamental Lighting Standard.

The height of this standard to the central globe is 14 feet, 3 inches. The spread of the arms from center to center of opposite globes is 36 inches. The claim is made that this is the proper height for curb lighting, as it insures the proper diffusing of light on the sidewalk and illuminates store fronts and show windows at the proper angle. However, the cluster is high enough not to interfere with the view of the windows from the street. The column is of graceful design and, due to its simple lines, is easy to clean and repaint. The complete standard weighs 600 pounds and is made for one, three or five lights.

The Cutter Company offers to assist central stations with the advice and practical help of its engineering and advertising departments both to advocate ornamental street lighting in a community and to assist in closing contracts for such installation.

Alternating-Current Flaming-Carbon Arc Lamps.

Their high efficiency and intense light have made flaming-arc lamps very desirable for many cases of high-power illumination, but these lamps have had the serious drawback of requiring frequent trimming. This drawback has been overcome and the distribution of light considerably improved in the long-burning flaming-carbon arc lamps of the Westinghouse Electric & Manufacturing Company, which have a burning life of over 100 hours.

By employing yellow-light carbons great intensity and high penetrating power are obtained, thus making these lamps suitable for the lighting of smoky or dusty interiors of foundries, train sheds, and steel mills, and for foggy places, such as wharves and lighthouses. They are also very satisfactory for display lighting in front of stores, theaters, or other large public buildings.

For street-lighting purposes white-light carbons are recommended. The arrangement of vertical carbons and a reflector to slightly modify the distribution curve, results in a distribution of light excellent for the lighting of streets, parks, and public squares.

To secure long burning life of the carbons the arc is inclosed in a chamber to which the supply of air is limited, as in the case of the standard inclosed arc lamp. In the flaming-carbon lamp, however, the efficiency is reduced very little by the inclosure. Only one globe is used, of a peculiar design that enables it to perform the double function of inclosing globe and condensing chamber for the heavier fumes from the arc.

The lower part of the lamp shell constitutes a condensing chamber for the lighter fumes from the arc. In operation the lighter fumes rise into this chamber and deposit on its cooler surfaces. By reason of the large surface it is not necessary to clean it out except at very long intervals. This condensing chamber is separated from the mechanism chamber, and can be readily cleaned by the trimmer without removing any part but the globe. The lower part of the globe acts as a condensing chamber for the heavier fumes. As the upper portion of the globe is warm, it has no deposit and remains clean to the end of the trim. By this means a lamp having a life of approximately 100

hours and comparing favorably in candlepower and efficiency with the short-burning type has been obtained.

A large and rugged economizer is placed above the arc, shielding the lower frame casting and the mechanism chamber from the heat.

The mechanism is contained in two separate chambers. The lower of these in the series lamp contains the framework of the lamp, the upper carbon guides, and the starting resistors. Ample ventilation is provided by screened openings in the case at each end of the lower mechanism chamber to remove the heat generated by the resistors.

The upper chamber in the multiple lamp contains the auto-transformer and all the control mechanism of the lamp. The upper frame casting forms its base and the cover is a solid cap which fits tightly around this casting and is held

Aternating-Current Flaming Arc Lamp.

in place by a bayonet joint. As the mechanism is remote from the arc and in a dustproof chamber, all troubles from heat, fumes, and dirt are avoided.

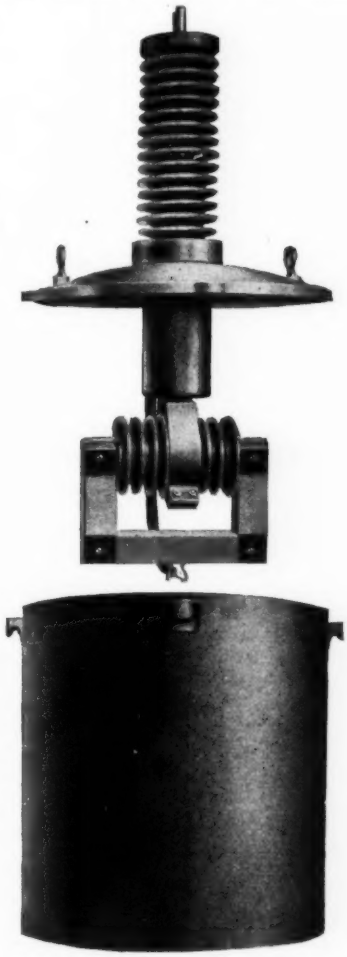
Each lamp undergoes a 2,000-volt test for one minute before shipment. The standard alternating-current series lamp is adjusted for 10 amperes with 50 volts at the terminals, but may be operated on series circuits of lower current value by using a separate auto-transformer with each lamp.

The multiple lamp is adjusted for 10 amperes at the arc, 6.5 amperes at the terminals on 100 volts, and consumes 425 true watts and the electrical efficiency is 83 per cent.

A NEW CURRENT TRANSFORMER FOR HIGH-VOLTAGE SERVICE.

By S. P. Russell.

To those who are familiar with the current transformer, the tedious description of the inter-related electric and magnetic paths and the various uses of the same would be as tiresome to the reader as to the writer. Volumes of analyses have been written



Current Transformer with Oil Tank Lowered.

and are easily accessible to those who desire such, some of the best being procurable at the Bureau of Standards, Washington, D. C.

The current transformer dates back to the beginning of alternating-current practice, but it has lagged behind other electrical apparatus in design, finish and reliability.

Originally it was a safety device, permitting the removal of dangerous wires from the switchboard, and from direct contact with all instruments that might be handled.

When the high-tension transmission systems were first placed in service, no current transformers were developed for such severe duty. There were many other pressing problems to solve without trying to do much with relays, meters or automatic switches on the main line. Therefore hand control was the rule of operation.

All current was metered at the generator voltage, or else the meters were placed on the low-voltage side of the receiving transformers.

With the enormous growth of power-transmission systems and their interwoven network of lines, high-voltage current metering became necessary and the current transformer was also needed for the operations of relays and trip coils.

The percentage of failure that followed the trial of the early high-tension current transformer greatly retarded its general use. Its weakness was in the design and method of insulation.

Its lack of efficiency is well illustrated by the following story related

Side View of Transformer with Tank Removed.

by a friend, who stated that on a recent trip to Los Angeles, while in conversation with an engineer, the statement was made that they could set their watches by the current transformers. On being pressed for an explanation, the engineer stated that at some critical stage or condition of the load at regular intervals one or more high-voltage current transformers would have its "baptism of fire" with the usual accompaniment of interrupted service, etc. This story, of course, is an exaggeration of facts, but it is so far true that current transformers for high-voltage service are in bad odor, due to excessive cost and unreliability

and that they are omitted in many cases where it is a real hardship to do without them.

These conditions demanded something better, with the result that there is now on the market a current transformer which is practically immune, and which lacks this time-keeping quality of its predecessors.

This transformer is unique, standing alone in an apparent contradiction of all supposedly sensible and reasonable apparatus, and performing the duties for which it was conceived, i. e., a reliable 24-hour-a-day means of registering the power flowing in high-tension power lines.

As shown by the accompany illustrations, fewer parts and a simpler construction cannot be obtained, and this piece of apparatus is considered final in the essential qualities of simplicity, permanent high insulation and safe operation.

This current transformer has an outlet bushing with copper bar terminals, or primary leads, molded in. This bushing is mounted on the cover, and in turn supports the transformer carcass in a novel manner. The carcass is composed of one porcelain bushing, one primary coil, two secondary coils, one cast-copper shackle (in two parts), and the laminated-iron core. The bushing is recessed at both ends to admit the secondary coils, and the outside waist of the bushing is contracted to hold the primary coil. The two parts of the shackle are insulated from one another by suitable fiber blocks and bushings, and the insulating coupling held together with two bolts passing through metal flanges, fiber block and bushing, thus making a strong rigid shackle, which is bolted to the primary leads. The two ends of the primary coil are electrically connected to the shackle in such a manner that the shackle is always one turn of the primary winding, i. e., part of the first, and part of the last turn.

With the laminated-iron core passing through the bushing and suspended therefrom, we have the novel condition of a transformer hanging by its primary leads. By this simple means of suspension the task of insulation is so much lightened as to be easily accomplished. The secondary leads are brought out through a rigid metal conduit attached to the cover, which results, when lifting the cover, in the removal of the whole transformer. This is so light that with the exception of the 100-kilowatt transformer, one man can easily handle it.

The tank is a one-piece boiler-plate, acetylene-welded tank, and the assembled transformer after being filled with clean, dry Mineral Seal oil is practically indestructible.

This patented transformer is made for three principal voltages, i. e., 40,000, 60,000 and 110,000 volts. It is built for any range of current from 5 to 500 amperes, the secondary coils being wound for 5 amperes on all sizes. It is sold exclusively by the H. W. Johns-Manville Company. The company is prepared to manufacture these transformers in indoor and outdoor types for all voltages up to 150,000 volts.

Greenfielduct.

The Sprague Electric Works of the General Electric Company, New York City, has recently placed on the market a rigid iron conduit known to the trade as Greenfielduct. It is claimed by the manufacturer that this possesses advantages over all other types of rigid iron pipe, due to the fact that it is treated with hot galvanizing on both the interior and exterior surfaces, the process being such as to afford a standard sulphate of copper dip test equivalent to seven or more dips.

The reputation which Greenfield BX cable has achieved is due largely to

Rigid Iron Conduit.

the treatment of the steel armor with molten zinc, and as BX cable has been found to wear unimpaired under conditions which might otherwise have resulted in rusting of the armor, there is good reason to conclude that Greenfielduct having a similar hot galvanized finish, will prove equally serviceable.

A New Type of Air-Driven Boiler-Tube Cleaner.

The air or steam-driven type of boiler-tube cleaner has been found the most satisfactory in many power plants because water is expensive or the pressure is too low to give sufficient power to drive a water-turbine cleaner.

Plants in which these conditions obtain will undoubtedly be interested in a new type of air or steam-driven cleaner, recently perfected by the Lagonda Manufacturing Company, of Springfield, O. The compressed air or steam passes through two ports in a plate in the rear end of the cleaner, then through transverse openings in the rotor, and out through branch openings to the space behind the paddles. There are only two ports opening into the air chamber, thus only the two paddles that are doing the work are under air pressure, and there is no communication to the two idle paddles, thus one of the main difficulties with other types of air-driven cleaners has been eliminated, that is, excessive leakage of air. After the air has done its work behind one of the paddles, the paddle uncovers an exhaust port and the expanded air is allowed to pass out through the front end of the cleaner.

This cleaner is of extremely simple design, and has few parts, all of which are made extra heavy to stand the hard bumps to which a boiler-tube cleaner is always subjected in removing hard scale.

To permit the cleaner of operating economically under different air pressures and in different hardnesses or thicknesses of scale, two interchangeable rear plates are provided having port areas of different sizes. Where there is a limited amount of air available the plate with the smaller holes can be used, thus insuring plenty of power with small amount of air. If the scale is heavy and plenty of air can be furnished, the plate with larger holes can then be used and more power developed.

Due to the efficient design and sturdy construction, the makers claim that this air cleaner will develop more power with less air consumption than any other type so far perfected, and to prove their claims they are willing to lend their cleaner to any reliable firm and allow it to test it out thoroughly.

The cleaner is furnished with either the Weinland quick-repair head, or with other types manufactured by this company, and is built for cleaning tubes of one to four inches in diameter and a special design is suitable for use in curved tubes.

Baltimore & Ohio to Install More Telephones.

The Baltimore & Ohio Railroad, which was one of the pioneers in the telephone train-dispatching field, has recently placed another order with the Western Electric Company for selector equipment to be used in extending its facilities for dispatching trains by this method.

The division to be equipped lies west of Cincinnati, Ohio, extending from that place to Montgomery, Ind., and branching off at Seymour, Ind., to go to Louisville, Ky., and Jeffersonville, Ind. There will be three circuits paralleling each other, one train wire for transmitting train orders, a message wire for transmitting messages in general, and a block wire to enable the block tower men to get into quick communication with each other. A feature of the message wire is that it is arranged for intercalling, that is, way stations can call each other.

The apparatus to be used includes the new Western Electric selector set. There will be 100 selector stations so equipped, covering a stretch of approximately 250 miles. In all there will be over 800 miles of circuit.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

PURCELL, OKLA.—This city has voted $100,000 light and water bonds.

ORTONVILLE, MINN.—The electric light line will be extended to the Peninsular.

OSHKOSH, WIS.—It is proposed to establish a system of Corinthian lights on Main Street. C.

MENLO, IOWA.—Buckey & Garnet have been granted an electric light franchise at this place. C.

MARION, KY.—The Marion Electric Light & Ice Company contemplates enlarging its plant.

CHESTER, PA.—The Beacon Light Company is preparing plans for doubling its present system.

JEFFERSTOWN, KY.—The Louisville Lighting Company will extend its system to this place.

BOVEY, MINN.—The arc lights between this place and Coleraine will be replaced with Tungstens.

LAVONIA, GA.—The city has voted a $5,000 bond issue for the purpose of extending the electric light plant.

STOCKDALE, TEX.—V. B. Colby, of Smiley, Tex., will build an electric light and ice plant at this place.

IDA GROVE, IOWA.—Electroliers will be installed on Main Street for five blocks. The cost is estimated at $3,000. C.

HOLLAND, MICH.—A new dynamo, estimated to cost $28,000, will be installed at the municipal electric light plant.

ST. GEORGE, S. C.—The Commissioners of Public Works contemplate the construction of a municipal electric light plant.

WYNNE, ARK.—This city will rebuild its electric light plant. Richard C. Huston, Memphis, Tenn., is the engineer in charge.

COLERAINE, MINN.—W. W. Hunter, clerk, will receive bids until June 15, for 48 12-foot posts. Check for $100 must accompany bids. C.

DULUTH, MINN.—The West End Commercial Club is agitating the establishment of a "White Way" for Twenty-first Avenue. C.

OLEON, N. Y.—The Western New York & Pennsylvania Traction Company is preparing to build a $250,000 power plant here.

BEVERLY, MASS.—The City Council has made an appropriation for the installation of 43 new lamps of the luminous arc type.

BARNWELL, S. C.—The City has voted a bond issue of $22,000 for the purpose of constructing an electric light and waterworks plant.

BEDFORD, IND.—Bids are being asked by the City Council for three electrically-driven centrifugal pumps. James Stevenson is city clerk. S.

SAGINAW, MICH.—Mayor Stewart and the Common Council have in hand the matter of an improved street lighting system for Saginaw.

MAQUOKETA, IOWA.—The Barnes Electric Light & Power Company will enlarge its plant, install another dynamo and build a line to Anamosa. C.

MIDLAND, MICH.—The Dow Power Company has been organized with a capital stock of $10,000. Herbert H. Dow is the principal stockholder.

RICHMOND, IND.—Steps are being taken toward the installation of a modern ornamental street lighting system in the principal streets of this city.

ROME, N. Y.—The Bell Telephone Company will place all its wires underground. The work will start at once and must be completed by November 30.

ROCHESTER, MINN.—The Oscar Clausen Engineering Company, of St. Paul, is making plans and estimates for improving the municipal electric light plant. C.

BEAUMONT, CAL.—A party of Los Angeles capitalists, headed by L. E. Rogers, is considering the establishment of an electric light plant at this place.

OLIVET, MICH.—A 30-year franchise has been granted to the Commonwealth Power Company to construct lines and operate within the village of Olivet.

ST. CLOUD, MINN.—The City Engineer has been instructed to prepare an estimate on the cost of installing cluster lights on St. Germain Street and Fifth Avenue.

THERESA, WIS.—Theresa Electric Light & Power Company has been incorporated with a capital stock of $7,000 by Nathan Haessley, P. F. Langenfeld and Henry Felling.

EL PASO, TEX.—The El Paso Gas & Electric Company has entered upon another campaign of improvements which calls for the expenditure of $60,000 this summer.

SPENCER, N. C.—The Southern Railway Company, of which B. Herman is chief engineer, will erect a building and equip for developing 5,000 electrical horsepower.

ROME, WIS.—The Bark River Electric Light & Power Company has been incorporated with a capital stock of $5,000 by H. H. Lepper, Alice J. Lepper and A. A. Lepper.

PALMER, MASS.—The Central Massachusetts Electric Company has obtained a franchise to erect poles for supplying electricity for light and power purposes, the work to be completed within one year.

BIG STONE GAP, VA.—The Virginia Hydro-Electric Company has been incorporated with a capital stock of $10,000. J. R. Paull, of Pittsburgh, is president of the company.

OCONOMOWOC, WIS.—Oconomowoc River Power Company has been incorporated with a capital stock of $30,000 by W. S. McDowell, O. M. Rau and Henry Schoellkopf.

NORTH MANCHESTER, IND.—The North Manchester Flour Mill Company has contracted with the city to install arc and incandescent lamps throughout North Manchester. S.

CHATTANOOGA, TENN. — The Chattanooga Railway & Light Company is planning to spend $228,000 on betterments to its system. W. E. Boileau is general manager at Chattanooga.

TORONTO, ONT.—Sir William Mackenzie is credited with the statement that a duplication of the transmission line between Toronto and Niagara Falls will be commenced at once.

MARLIN, TEX.—The Citizens Ice, Light & Power Company of Marlin has been organized with a capital stock of $30,000. The incorporators are W. H. Wiggins, O. B. Wiggins and F. L. Solom. D.

TECUMSEH, OKLA.—The Rapid Transit Interurban Company of Tecumseh proposes to establish a powerhouse of sufficient capacity to furnish the towns along its line with electrical energy.

KINGWOOD, W. VA.—West Virginia Power & Transmission Company has been incorporated with a capital stock of $50,000 by Frederick W. Scheidenhelm, Gerard H. Matthews and others.

STOCKTON, CAL.—The Western States Gas & Electric Company has plans under way for the installation of an underground system of service wires, which will necessitate the expenditure of at least $200,000.

JOHNSTOWN, PA.—The County Commissioners have awarded a contract to W. J. Johnson, of Latrobe, for the erection of a power house. It is estimated that the cost of the power house will be $4,600.

LAS VEGAS, N. M.—Articles of incorporation have been filed for the Mora Light & Power Company, having a capital stock of $5,000. The directors are Joseph J. Fuss, Henry J. Shaw and J. Franklin Hornig.

LAFAYETTE, IND.—The Merchants Electric Light Company has notified the Secretary of State of an increase of capital stock from $200,000 to $350,000, and proposes making extensive improvements. Parker A. Byers is president. S.

HIBBING, MINN.—General Manager O. H. Griggs of the Virginia Electric Power & Water Company has announced that his company has decided to expend about $50,000 in extensions and improvements to the plant.

MONTGOMERY, ALA.—The Alabama Interstate Power Company will begin work on the construction of a dam and power house on the Coosa River within a few weeks. James

Mitchell is president of the company.

CLARINDA, IOWA.—The Lee Electric Light Company has purchased the Corning Light, Heat and Power Company, and will supply the current from here *via* Gravity. The poles from Gravity to Corning will be steel set in concrete. C.

CHICOPEE, MASS.—The Amherst Power Company has secured an entrance to the city of Chicopee, and will this summer build a double steel-tower transmission line from Turners Falls to Amherst, and erect a large transformer station.

HARRISBURG, PA.—The following power firms have received charters to operate in Bucks County and each have a capital stock of $5,000; Southern Bucks, Morrisville, Township of Bristol, Township of Lower Makefield and Township of Falls.

ROSEVILLE, CAL.—The Great Western Power Company has been awarded the contract for installing a distributing station at this point, and has also secured the contract for supplying energy for city lighting at one cent per kilowatt-hour.

SOUTH EDWARDS, N. Y.—Ball Brothers have charge of the preliminary survey for the power line which is to be built to Carthage. It is stated that when the improvements to the power plant are completed about 1,200 horsepower will be generated.

NEW ROCKFORD, N. D.—Sealed proposals will be received at the office of the County Auditor until June 10 for an electric lighting plant. A certified check of 10 per cent of the amount of bid, made payable to the County Treasurer, must accompany each bid.

OSAGE, IOWA.—Farris Brothers, owners of the Osage electric light plant, will erect a steam-electric plant. This was made necessary by the damage done by the high water to the water-power plant. As soon as this is completed they will repair the dam and establish a day service. C.

BURLINGTON, N. C.—Almanace Power Company is issuing $300,000 worth of bonds for the purpose of constructing a hydroelectric plant on the Haw River. F. L. Williamson, Burlington, is president of the company, and J. Harvey White, of Graham, is secretary.

INDIANAPOLIS, IND.—An eight-story power building will be erected on Market Street by Mrs. A. B. Mansur. The building which will cost about $125,000, is designed to accommodate small manufacturing concerns and will be fitted up with every known apparatus for electric power.

MONTICELLO, IND.—The Northern Indiana Utilities Company has filed articles of incorporation. The capital stock is $1,075,000 and the directors are Charles A. Monroe, John W. Joachim, Rowan Hardin, Henry Klauber and R. G. Gordon. The new company will develop water power on the Tippecanoe River near Monticello. S.

MADISON, WIS.—The Peninsula Power Company, of which E. W. Mead is the chief engineer, has been incorporated with a capital stock of $850,000. Permission has been granted the company by the State Railroad Commission to issue $1,000,000 worth of bonds. It is the intention of the company to build a dam and erect a waterpower plant on the Menominee River.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

GULLY, MINN.—The Garden Valley Telephone Company will extend its line soon.

PARK RAPIDS, MINN.—The telephone line between here and Bemidji will be rebuilt. C.

WOOD, S. D.—The Nebraska Telephone Company will establish an exchange here. C.

KELLOGG, MINN.—The Greenfield Farmers Telephone Company will build its line up Cook's Valley. C.

COHASSETT, MINN.—It is proposed to extend the line of the Messaba Telephone Company about 12 miles. C.

MORRISTOWN, MINN.—Geo. Bahr and others have incorporated the Morristown Telephone Company with a capital of $10,000. C.

ALTO, TENN.—The Alto Telephone Company has been incorporated with a capital stock of $1,000 by S. S. Swann, A. Garner, Sr., J. H. Clark and others.

ALTURAS, CAL.—The firm of Leland & Myres has been granted permission to operate telephone lines along public thoroughfares of Modoc County, according to recent reports.

CUMBERLAND, WIS.—Town Line Telephone Company has been incorporated with a capital stock of $875 by C. E. Hook, W. N. Fuller and Will Williams.

RIPON, WIS.—Ripon United Telephone Company has been incorporated with a capital stock of $40,000 by G. F. Horker, J. B. Barlow, Jr., and S. M. Pedrick.

SPOKANE, WASH.—The Inland Telephone & Telegraph Company has been incorporated with a capital stock of $250,000 by John W. Fisher and William G. Barlow.

NASHVILLE, TENN.—Stove Gay Home Telephone Company has been incorported with a capital stock of $200. The incorportors are J. P. Scott, D. H. Beard, F. J. Robinson, Harris Howlett and Charles Day.

DEER RIVER, MINN.—The farmers of Jessie Lake have formed a company and will build a line to this place. They have leased the poles of the Deer River Rural Telephone Company for five years. C.

ALGONA, IOWA.—The Algona Rural Telephone Company has been incorporated with a capital stock of $1,000. The incorporators include F. A. Witham, Thomas Rich and A. S. Walker.

MISSOULA, MONT.—Work will soon begin on the construction of 145 miles of pole line for the Mountain State Telephone & Telegraph Company, connecting Missoula with Thompson and Ravalia. It is announced that the cost of this construction will be $100.00.

UNITY, WIS.—The Atwood Telephone Company has been incorporated with a capital stock of $600. The incorporators are William Rusch, William Hardrath, Fred Molle, David Mandel, Edward Klessig and Henry Molle.

WAITEVILLE, W. Va.—Upper Potts Valley Telephone Company has been incorporated with a capital stock of $520. The incorporators are C. H. Doss, C. C. Patton, J. W. Williams, T. G. Crozier and B. B. Williams, all of Waiteville.

ELECTRIC RAILWAYS.

(Special Correspondence.)

DES MOINES, IOWA.—The Iowa Terminal Company has been incorporated with a capital stock of $500,000. C.

DUBUQUE, IOWA.—A franchise has been granted to the Union Electric Company for a line to Eagle Point Park. C.

DULUTH, MINN.—The West End Commercial Club is agitating the extension of the street car line to Hermantown and Proctor.

MANCHESTER, N. H.—The Boston & Maine Railroad, it is rumored, will construct an electric railway up Mount Washington.

KALISPEL, MONT.—David R. McGinnis, president of the Flathead Interurban Railway, proposes to construct a line to Calgary, Alta. C.

MOHNTON, PA.—The Wyomissing Valley Connecting Railway Company has been organized to build an electric line four miles long.

LEWISTOWN, ILL.—It is announced that $100,000 worth of bonds have been sold for financing the Canton Interurban Line to St. Cloud.

BLOOMINGTON, ILL.—It is stated that $67,000 has been appropriated by the Illinois Traction System for improvements to its line in Bloomington this year.

HARTFORD CITY, IND.—The Union Traction Company of Indiana will spend about $12,000 for improvements in this city during the present summer.

BEAUMONT, TEX.—Samuel F. George, of Houston, submitted a proposal to the business men of Beaumont and Orange recently to build an electric railway connecting the cities of Beaumont, Orange and Port Arthur.

WINNECONNE, WIS.—F. H. Hull is at the head of a movement for an electric line to Oshkosh, and if the Wisconsin Electric Company does not construct such a line, the citizens of this place will build and operate it themselves. C.

PHILADELPHIA, PA.—The Philadelphia & West Chester Traction Company has obtained rights of way and franchises for its proposed extension from Drexel Hill to Media. It is reported that bids will be called for immediately.

SALEM, ORE.—It is rumored that with the recent acquisition of the Portland Railway, Light & Power Company by A. Welch, the line to Silverton will be completed at an early date and many extensions and improvements made to the company's lines.

KENOSHA, WIS.—The Milwaukee Electric Railway & Light Company has purchased the Kenosha Electric Railway & Light Company, and will connect the Kenosha system with the Milwaukee system and make many improvements here.

TAMPICO, MEX.—S. Pearson & Son, Limited, is preparing to construct and operate an extensive system of electric railways in Tampico. This firm recently purchased the two electric light plants here, which will be merged into one central lighting and power station. Besides the street railway system, the Pearson syndicate, as it is called, will construct two or more interurban electric lines. One of these will run to La Barra, which is situated at the point where the Panuco River empties into the Gulf, six miles below the city. A. E. Worwick, chief engineer of the Pearson Syndicate, is here to direct the construction work. D.

NEW INCORPORATIONS.

LANCASTER, PA.—The West Chester Electric Company has been incorporated with a capital stock of $5,000.

DALLAS, TEX.—Citizens' Ice, Light & Power Company has been incorporated with a capital stock of $30,000 by W. H. Wiggins, O. B. Wiggins and F. L. Solon.

DALLAS, TEX.—The Modern Electric Supply Company has been organized with a capital stock of $250,000 by Walter G. Endicott, W. I. Davis, of Dallas, and R. H. Busby, of McAllister, Okla.

NEW YORK, N. Y.—Finkenstein Electric Company, Incorporated, has been incorporated with a capital stock of $5,000 by Morris F. Finkenstein, Meyer Bank and Max Goldberg, of New York.

FORT PLAIN, N. Y.—Fort Plain Electric Piano Company, Incorporated, has been incorporated with a capital stock of $11,000 by John M. Jordan, Charles J. Lumley and John E. Barker, all of Fort Plain.

NEW YORK, N. Y.—Ever-Ready Electrical Company has been incorporated with a capital stock of $3,000. The incorporators are Morris Janiger, Abraham J. Khoel and Henry M. Orenstein, all of New York City.

NEW YORK, N. Y.—Ked Sign Company has been incorporated with a capital stock of $1,000 to manufacture electric signs. The incorporators are Frank V. Daniels, Emil Heydolph and Nina Kleinman, all of New York City.

NEW YORK, N. Y.—Mechelectric, Incorporated, has been incorporated with a capital stock of $10,000 to manufacture patented devices. The incorporators are John J. Meckler, Allen A. Canton and Irving Nemoff, all of New York City.

CHICAGO, ILL.—Economy Electric Sign Company has been incorporated with a capital stock of $50,000 to manufacture and deal in signs of all kinds. W. B. Cooley, Roderick W. McKinnon and J. C. Cooley are the incorporators.

CHICAGO, ILL.—Illinois Public Service Company has been incorporated with a capital stock of $1,000 to operate power plants, telephone and telegraph lines and other utilities. The incorporators are Gerard A. Connor, Charles E. Loy and Edwin D. Lawlor.

CLEVELAND, O.—The Eureka Electric Company has been incorporated with a capital stock of $15,000 to deal in electrical machinery, appliances and equipment of all kinds. A. S. Dole, H. H. Coyne, Samuel Lazarus, William Rothenberg and William R. Miller are the incorporators.

PROPOSALS.

WIRE, CRUCIBLE, CAST-STEEL, GALVANIZED.—Sealed proposals will be received by the Navy Department, Bureau of Supplies and Acounts, Washington, D. C., until June 18 for miscellaneous wire to be delivered at the Navy Yard, Boston, Mass., as per schedule 4584.

TRANSMISSION LINE.—Sealed proposals, in triplicate, will be received at the office of the Constructing Quartermaster, Seattle, Wash., until May 31 for the construction of a substation and a transmission line and furnishing a rotary converter, transformers, wattmeters and other electrical apparatus at Fort Worden, Wash.; and the same for Fort Flagler, Wash. A deposit of $5.00 will be required for the return of plans. Further information will be supplied upon application to the Constructing Quartermaster.

ELECTRIC CONDUITS AND WIRING, AND INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., for electric conduits and wiring, and interior lighting fixtures until June 24 of a one-story building for the post office at Union, S. C.; until June 25 of a two-story building for the post office at Mansfield, O.; until June 26 of a one-story building for the post office at Newark, N. J.; until June 27 of a two-story building for the post office at Chester, Pa.; until July 1 of a two-story building for the post office at Newark, O. Drawings and specifications may be obtained from the custodian of the various sites or from the office of the Supervising Architect.

FINANCIAL NOTES.

Notwithstanding severe fluctuations in the prices of leading securities the ability of the stock market to digest these difficulties has been amply demonstrated, and it is apparently in strong hands and waxing more potent. Political and labor scares are becoming less disturbing and industrial reports record a very promising note. Incoming orders with the larger manufacturers are placing the steel business in much better condition and the position of the copper metal trade has also been strengthened during the week.

A loss in earnings, both gross and net, is shown in the annual report of the Westinghouse Electric & Manufacturing Company for the year ended on March 31. The company did a total business of $34,196,446, which is $3,922,866 less than was done in 1910-11. The net income available for dividends was $2,444,099, or just half the earnings of the previous year. The comparisons are less unfavorable if made with earlier years, 1910-11 having been a period of unusually large orders.

The surplus earned was equivalent to the full seven per cent dividend on the small amount of preferred stock, with a balance equivalent to slightly less than 6 per cent on the $36,700,287 of common stock. In the previous year the surplus amounted to 12.3 per cent on the common shares.

Three of the past seven years have shown larger profits for the Westinghouse Company than 1911-12. In 1909 there was a deficit of $1,405,000. The surplus shown a year ago was the largest ever reported by the company.

If the results of the past year's operations were in a measure unsatisfactory, from the stockholders' standpoint, the outlook for the current year is very favorable. During the month of April, the first of the new fiscal year, the value of the orders booked exceeded that for any month during the past year, making the total of unfilled orders as of April 30, $9,218,803.

The Guaranty Trust Company of New York has issued notice that holders of over 60 per cent of the stock of the Cleveland Illuminating Company have agreed to the terms of sale offered by a New York capitalist. Stockholders who are willing to sell at $130 a share had until May 23 to make their formal acceptance. Ten days more will be allowed for the deposit of all the stock of the Guaranty Trust Company. By June 1 the purchasers agree to say whether or not they will exercise the option to purchase. If they do shareholders will receive payment by June 15. The Central States Electric Company will be incorporated as a holding company to represent the control taken over.

The total amount of the pool of stock of the Louisville Gas Company, which owns the Louisville Lighting Company, as turned over to H. M. Byllesby & Company, and associates by the Louisville Trust Company and the Fidelity Trust Company amounted to 24,100 shares. This leaves only a few hundred shares other than those held by the city of Louisville outside the interests which have taken over the pool. The certificates were sent to the Continental National Bank of Chicago for distribution to the 52 members of the Byllesby syndicate, this being necessary on account of a charter provision which prevents the Byllesby company from owning more than 100 shares in any one corporation. The directors of the Louisville Lighting Company have elected the following officers: General George H. Harries, president; James B. Brown, vice-president; T. B. Wilson, secretary and treasurer; P. T. Glidden, general manager. The executive committee is composed of General Harries, Mr. Brown, John Stites, Thomas E. Murray and N. F. Brady, the latter two of New York. There will be no change in the directorate of the gas company until the annual meeting in July, when directors representing the new interests directly will be chosen.

There has been placed on the regular list at the Philadelphia Stock Exchange $2,898,300 additional capital stock of the American Telephone & Telegraph Company making the total listed $327,869,000.

To secure a loan of $15,000,000 for twenty-five years the Cumberland Telephone & Telegraph Company, Louisville, filed a first mortgage on all its property in Kentucky, Indiana, Tennessee, Mississippi and Louisiana to the Columbia Trust Company, of New York, and Frank W. Conn, of Brooklyn.

Ashley & Company, New York City, is offering for sale first-mortgage five-per-cent gold bonds of the Blue Ridge Electric Company, an underlying lien of the Georgia Railway & Power Company, which company agrees to retire the $1,135,000 of these bonds outstanding on or before October 1, 1916, at par and interest, and in the meantime to pay the interest.

A London cable announces that an offering by Higginson & Company, New York City, of $5,000,000 Virginia Railway first-mortgage five-per-cent bonds was oversubscribed. These bonds are part of an issue of $25,000,000 underwritten by a syndicate composed of Lee, Higginson & Company, Kissell, Kinnicut & Company, the National City Bank, and Drexel & Company.

The Tennessee Railway, Light & Power Company, recently incorporated to take over the Nashville Railway & Light Company, the Chattanooga Railway & Light Company, the Cleveland Electric Light Company and the Tennessee Power Company, has completed its organization. The company is now in operating charge of all its properties. It is incorporated under laws of Maine, with authorized capital of $50,000,000 six-per-cent preferred, $10,250,000 outstanding, and $20,000,000

common stock. Of the preferred stock $3,500,000, which was given in exchange for common stocks of underlying companies, will receive no dividends until after December 1, 1912. The company has no bonds except those of underlying companies. Earnings are sufficient to pay interest on all outstanding bonds and dividends on the $10,250,000 preferred stock outstanding. With the completion of the hydroelectric plants of the Tennessee Power Company and the extension of its transmission lines it is believed that the income of the company will increase rapidly.

The foreclosure sale of the Sedalia (Mo.) Railway & Light Company has been set for June 7. After the sale has been consummated the company will be reorganized and its operation will be turned over to Henry L. Doherty & Company, in the interest of the first-mortgage bondholders. The company, which operates the street railway, electric light and power and gas services of Sedalia, was placed in the hands of receivers in June, 1910, on a suit brought by the City Trust Company, trustee for the bondholders. A committee of bondholders, composed of Otto T. Bannard and other New York men, which has been working toward a reorganization, has accepted the plan proposed by Henry L. Doherty & Company. As soon as the property is bid in by the bondholders' committee it will be turned over to a new company to be organized under the laws of Missouri. The new company will have an authorized bond issue of $2,500,000, of which only $400,000 is to be now issued; $500,000 preferred stock, $400,000 to be issued and $2,000,000 common stock.

The New York Curb Market Association listing committee has received information that the plan of Marconi Wireless Telegraph Company of America, dated April 10, 1912, has been declared operative and that the Corporation Trust Company, of Jersey City, is delivering temporary certificates to subscribers and stockholders. The committee rules that on and after Monday, May 20, temporary certificates for new American Marconi stock, par value $5, are delivery in settlement of all outstanding contracts. The listing committee has also approved application of Marconi Wireless Telegraph Company of America to list 2,000,000 shares of common stock, par value $5, fully paid, and it rules that on and after May 20 all transactions in American Marconi will be the regular way, unless otherwise specified.

Dividends.

American Railway Company; the regular quarterly dividend of 1.5 per cent, payable June 15 to stock of record May 31.

Columbus Railway Company; a regular quarterly dividend of 1.25 per cent on the common stock, payable July 1 to stock of record May 15.

Eastern Pennsylvania Power Company, a quarterly dividend of 1.75 per cent on the preferred stock, payable to stockholders of record April 30.

General Electric Company; a quarterly dividend of two per cent, payable July 15 to stock of record June 1.

New York Transit Company; a dividend of ten per cent, payable July 15 to stock of record June 15.

Philadelphia Electric Company; the regular quarterly dividend of 1.5 per cent on the preferred stock, payable June 1 to stock of record May 21.

Reports of Earnings.

INTERNATIONAL RAILWAY COMPANY.

Report of the International Railway Company, of Buffalo, for the quarter ended March 31, 1912, compares as follows:

	1912	1911
Gross	$1,188,304	$1,138,194
Net after taxes	340,537	344,273
Surplus after charges	143,587	139,398

UNITED TRACTION COMPANY.

The report of the United Traction Company, (Albany-Troy) for the quarter ended March 31, 1912, compares as follows:

	1912	1911
Gross	$560,584	$537,234
Net after taxes	111,733	136,713
Other income	54,474	50,952
Total income	166,208	187,665
Surplus after charges	58,095	84,805

PHILADELPHIA COMPANY.

The report of the Philadelphia Company for the fiscal year ended March 31, shows net earnings of $3,967,875, a decrease of $57,055. The income account, with changes, follows:

	1912	Increase
Gross earnings	$6,618,524	$ 79,684
Operating expenses and taxes	2,650,649	136,739
Net earnings	$3,967,875	*$57,055
Other income	2,768,832	263,057
Total income	$6,736,707	$206,002
Charges, etc.	1,288,200	21,932
Balance	$5,448,507	$184,070
Improvements, betterments, etc.	917,639	*716,188
Balance	$4,530,867	$900,258
Preferred dividends	300,000	.....
Balance	$4,230,867	$900,258
Common dividends	2,721,198	162,791
Balance	$1,509,669	$737,466
Miscellaneous deductions	1,178,111	857,724
Surplus	$ 331,558	*$120,258
Previous surplus	5,062,594	451,815
Total surplus	$5,394,152	$331,557

*Decrease.

INTERBOROUGH RAPID TRANSIT.

The Interborough Rapid Transit Company reports for nine months ended March 31, 1912, compared as follows:

	1912	1911
Gross	$ 23,180,395	$ 22,122,895
Net	13,406,203	12,956,077
Taxes	1,462,599	1,393,206
Income from operations	11,943,604	11,562,871
Other income	283,278	251,660
Total income	12,226,883	11,814,531
Charges	8,248,457	7,986,297
Surplus	3,978,426	3,828,233
Dividends	2,635,000	2,362,500
Surplus	1,353,426	1,465,733
Passengers carried	450,450,367	429,417,352

UNITED RAILROADS OF SAN FRANCISCO.

The report of the United Railroads of San Francisco, controlled by the United Railways Investment Company, for the year ended December 31, 1911, compares as follows:

	1911	1910
Gross	$7,886,136	$7,653,489
Expenses and taxes	4,706,971	4,729,270
Net	3,179,165	2,924,218
Other income	264,627	90,278
Total income	3,443,792	3,014,497
Charges, etc.	2,095,213	2,045,518
Balance	1,348,579	968,979
Sinking funds	339,619	367,070
Surplus	1,008,960	601,909

Out of the $1,008,960 surplus of 1911, $473,168 was paid out for renewals, depreciation, and contingencies, and $350,000 for dividends on first preferred stock.

HUDSON & MANHATTAN RAILROAD.

The report of the Hudson & Manhattan Railroad Company for the fiscal year ended March 31, 1912, shows a surplus after charges of $50,279, against a deficit of $41,890 the previous year. Net earnings were $2,749,474, against $2,315,052 in 1911. The total number of passengers carried on a five-cent basis for the year was 60,588,126, against 50,926,980 the year before. The income account compares as follows:

	1912	1911
Gross revenue, all roads	$4,845,491	$4,165,492
Oper. expenses and tax.	2,096,017	1,850,440
Gross income	2,749,474	2,315,052
Int. on bonds outstand'g	2,951,427	2,918,007
Less int. chg. to const.	535,984	819,192
Balance interest	2,415,443	2,098,815
Other charges	283,751	258,126
†Total deduc. from inc.	2,699,194	2,356,942
Surplus	50,279	*41,890

† Being fixed charges applicable against that portion of the property employed in present operations.
* Deficit.

NEW YORK STREET RAILWAYS.

The summary of street railway operations in New York city for the month of January, as prepared by the New York Public Service Commission for the First District, shows that the net earnings of the Interborough system exceeded those of any other city line. The statement is in part as follows:

	Street railway operating revenues.	Street railway operating income.
Hudson & Manhattan	$ 318,699	$177,214
Interborough (sub. div.)	1,501,426	893.351
Interborough (elev. div.)	1,332,710	618,732
B. R. T. System	1,821,948	547,335
Manhattan surface roads (N. Y. railways not included)	501,976	158,454
Bronx surface roads	315,694	29,115
Queens surface roads	141,465	*37,847
Other companies	138,204	8,670

*Deficit.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	May 20.	May 13.
Allis-Chalmers common (New York)	1	1
Allis-Chalmers preferred (New York)	2	1⅞
American Tel. & Tel. (New York)	145¾	145¾
Commonwealth Edison (Chicago)	141	142
Edison Electric Illuminating (Boston)	292	292
Electric Company of America (Philadelphia)	12¼	*12
Electric Storage Battery common (Philadelphia)	55¾	55
Electric Storage Battery preferred (Philadelphia)	55¾	55
General Electric (New York)	169½	169
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	2¼	2⅜
Massachusetts Electric common (Boston)	19½	19½
Massachusetts Electric preferred (Boston)	*95	95
National Carbon common (Chicago)	115	112
National Carbon preferred (Chicago)	116	116¼
New England Telephone (Boston)	153¾	155
Philadelphia Electric (Philadelphia)	19⅝	19⅛
Postal Telegraph and Cables common (New York)	83½	82
Postal Telegraph and Cables preferred (New York)	69	68⅝
Western Union (New York)	82¾	83¾
Westinghouse common (New York)	73¾	76
Westinghouse preferred (New York)	117	118

*Last price quoted.

PERSONAL MENTION.

H. E. ALLEN has been appointed manager of the Heat, Light & Power Department of the Toledo Railways & Light Company, Toledo, O.

A. S. DUNCAN, assistant electrician of the Constantinople Telephone Company, Glasgow, has left London to take up his duties in Constantinople.

J. M. ENRIGHT, former superintendent of railways, has been appointed manager of the Railway Department of the Toledo Railways & Light Company.

J. E. BREAUX, JR., of the New Orleans office of the Cumberland Telephone Company, has been promoted to the managership of the Biloxi (Miss.) office of the company.

A. D. EVANS, for a number of years wire chief of the Wisconsin Telephone Company, Beloit, Wis., has accepted a position with the Chicago Telephone Company, Chicago, Ill.

GEORGE PETTIBONE has resigned the managership of the municipal lighting works at Westfield, Mass., after 28 years of service. Mr. Pettibone has not announced his plans for the future.

J. FRANK DOSTAL, general manager of the Colorado Springs Light, Heat & Power Company and Past Jupiter of the Sons of Jove, was married on April 24 to Miss Irene Jean Howard, of Denver.

W. H. FELTON, who for the past 17 years has been Judge of the Supreme Court of the Macon (Ga.) District, has tendered his resignation to become president of the Central Georgia Power Company.

CHARLES H. WACKER, chairman of the Chicago Plan Commission described the plans for a "Chicago Beautiful" before the Commonwealth Edison Section, National Electric Light Association, at the regular meeting in Chicago, Tuesday, May 21.

F. DOUGLAS WATSON, general manager and secretary of the Constantinople Telephone Company, (Société Anonyme Ottomane des Téléphones de Constantinople), left London on May 15 for Constantinople.

E. L. BENTON, superintendent of the Pike's Peak Hydroelectric Company, Manitou, Colo., has resigned his position with that company to become superintendent of the Lockport (N. Y.) Light, Heat & Power Company.

JOHN J. NOWLAND, general manager of the Evansville Public Service Company, has been appointed general superintendent of the Evansville & Southern Indiana Traction Company, to succeed L. C. Shepherd, who has resigned.

WILLIAM J. NIXON, who for some years previous to the administration of Mayor McCarthy, was chief of the Department of Electricity in San Francisco, has, since the administration of Mayor Rolph, been reinstated.

JAMES CAMPBELL, who has been president of the Milwaukee Electric Railway & Light Company, Milwaukee, Wis., has been elected chairman of the Board of Directors of the Company, a newly created position.

F. H. MEGGETT, of the Foreign Sales Department, Western Electric Company, addressed the Telephone Society of New York on May 21 on the subject of "The Western Electric Company's Share in Telephone Development Abroad."

C. F. HEWITT, general manager of East St. Louis Interurban Line, will become general manager of the Des Moines City Railway Company, to succeed J. R. Harrigan, who has resigned to go into railroad service in another city.

SAMUEL INSULL, president of the Commonwealth Edison Company, Chicago, gave an illustrated address before the City Club of Chicago on Thursday, May 23 on the subject of "Supplying the Energy Requirements of a Community."

EDWIN E. WITHERBY will assume charge of the Middle West Territory for the General Vehicle Company, with headquarters at Chicago, Ill. Mr. Witherby has recently been connected with the Pennsylvania Lighting Company at Shamokin, Pa.

J. B. MAHONEY, Superintendent of the Vernon (Conn.) station of the Connecticut River Power Company, has also been given the superintendency of the New England and Connecticut River Power Companies, with headquarters at Shelburne Falls, Mass.

JACK ABBOTT, general superintendent of the Jackson Railway & Light Company, Jackson, Miss., has resigned his position with that company to become associated with the Fort Wayne & Northern Indiana Traction Company, Fort Wayne, Ind.

HARRY ENGLE, formerly with the Youngstown Consolidated Gas & Electric Company, has accepted a position with Day & Zimmerman, of Philadelphia. Mr. Engle will be located in Oil City, Pa., where he will have charge of the lighting and power plant at this point.

A. C. MARTIN, formerly power engineer of the Rockford Electric Company, Rockford, Ill., has been made manager of the New-Business Department of the Rockford company, succeeding E. W. Osborne, who has accepted the position of new-business manager with the Scranton (Pa.) Electric Company.

G. S. BRACK, in the Electrical Engineering department of the Sanitary District of Chicago, has resigned his position to take up industrial work in Canada. Mr. Brack is a member of the Electric Club of Chicago, and at the last meeting of that organization the club passed a resolution wishing Mr. Brack prosperity in his new undertaking.

WILLIAM RAWSON COLLIER, Atlanta, Ga., has been appointed contract agent for the Georgia Railway & Power Company, the newly organized company which is to control practically all the water power in the Northern section of the State. Mr. Collier will be in charge of commercial development in a territory of about 200 miles square.

W. B. GOUDY, for some time in the employ of the Tri-State Railway & Light Company, East Liverpool, O., has been transferred to Rochester, Pa., where he is now the acting superintendent of the Valley Electric Company. This company as well as the East Liverpool one, is controlled by the J. G. White Company of New York.

W. L. ABBOTT, chief operating engineer, Commonwealth Edison Company, attended the ceremonies incident to the laying of the corner stone of a special building devoted to courses in commerce at the University of Illinois on May 21. Mr. Abbott attended this function in his capacity as president of the Board of Trustees of the University.

EDWARD W. BEMIS, of Chicago, has been appointed by Governor Goldsborough of Maryland to assist the Public Service Commission in the investigation of the affairs of the Consolidated Gas, Electric Light & Power Company, of Baltimore, with a view to establishing low rates for gas and electricity for the territory served by the Company. Mr. Bemis, who is expected to start his investigations at once, has seen considerable service as an expert in settling cases between municipalities and public-service corporations, and has won considerable prominence while serving as chief of the Cleveland Water Department under Mayor Tom L. Johnson. Under his administration the Water Department was put upon a paying basis. Afterward he was called to New York to help settle the gas problem in that city, and later performed similar service for Chicago.

DATES AHEAD.

Mississippi Electric Association. Fourth annual convention. Vicksburg, Miss., May 28-30.

American Society of Mechanical Engineers. Spring meeting, Cleveland, O., May 28-31.

National Electric Light Association. Annual convention, Seattle, Wash., June 10-14.

Minnesota Electrical Contractors' Association. Annual convention, Duluth, Minn., June 16.

Canadian Electrical Association. Annual convention, Ottawa, Ont., June 19-21.

Michigan Section of the National Electric Light Association. Annual convention on board the *Majestic*, sailing from Port Huron, Mich., on June 21.

National District Heating Association. Annual convention, Detroit, Mich., June 25-27.

Society for the Promotion of Engineering Education. Annual meeting, Boston, Mass., June 26-29.

American Institute of Electrical Engineers. Annual convention, Boston, Mass., June 25-28.

National Electrical Contractors' Association. Annual meeting, Denver, Colo., July 16-19.

Ohio Electric Light Association. Annual convention, The Breakers, Cedar Point, O., July 17-19.

International Association of Municipal Electricians. Annual convention, Peoria, Ill., August 26-30.

International Association for Testing Materials. Sixth congress, New York City, September 3-7.

Association of Iron and Steel Electrical Engineers. Annual convention, Hotel Pfister, Milwaukee, Wis., September 16-21.

The 1912 Boston Electric Show, Mechanics Building, Boston, Mass., September 28-October 26.

American Electric Railway Association and its five affiliated associations. Annual convention, Chicago, Ill., October 7-11.

Kansas Gas, Water, Electric Light and Street Railway Association. Annual meeting, Manhattan, Kans., October 17-19.

National Railway Electrical Engineers' Association. Atlantic City, June 12-19.

Promotion of Engineering Education. Boston, June 25-27.

With the Electrical Manufacturers

The Trumbull Electric Manufacturing Company, Plainville, Conn., is sending out with its usually bright monthly house organ "Trumbull Cheer," attractively colored postcards of its manufacturing plant.

Diehl Manufacturing Company, Elizabethport, N. J., is distributing Bulletin No. 58, descriptive of sewing-machine motors for manufacturing purposes. The bulletin is well illustrated, showing the various applications of this motor.

The American District Steam Company, North Tonawanda, N. Y., has issued bulletins Nos. 125 and 126. These contain reprints of papers by R. O. Warren and J. A. Bendure that will prove of value to those interested in central-station heating.

The Walpole Rubber Company, Walpole, Mass., has taken over the plant and business of the Consumers' Rubber Company, of Bristol, R. I. Under the same management all facilities will be utilized for continuing the manufacture of insulated wire and rubber shoes.

Lord Manufacturing Company, New York, N. Y., has moved its factory to Bush Terminal No. 7, Brooklyn, N. Y. The new location will give it unexcelled facilities for manufacturing and shipping, and connection with its rapidly growing business.

The Thompson Electric Company, Cleveland, O., is distributing a booklet illustrating and describing the Thompson safety cut-out hangers for arc lamps, large tungsten units and clusters. When lamps are lowered the cut-out disconnects electrical connections so that no danger from shock can result.

The Detroit Fuse & Manufacturing Company, Detroit, Mich., has ready for distribution catalog No. 21 devoted to "Detroit," Ironclad fused switches and motor starters, and "Arkless" indicating inclosed fuses. Complete information relative to the construction and application of these devices is given.

The Morris Iron Company, Frederick, Md., reports that the outlook for business during the coming year in ornamental poles indicates that the business of 1911 will be largely exceeded. During the past year it shipped over 2,500 ornamental poles in addition to the large number of lighting and railroad brackets and general foundry work.

The Western Electric Company, 463 West Street, New York, N. Y., has issued an attractive booklet entitled "Advertising Sunbeam Mazda Lamps in Newspapers." This contains numerous suggestions for advertising copy and a number of appropriate illustrations. The booklet will be sent by the company to anyone interested, and upon request cuts will be loaned free.

The Keystone Electric Metal Company, of Pittsburgh, Pa., which has been prosecuting research work for a year in that city, has moved to Bloomfield, N. J., where a plant is being equipped for the manufacture of tungsten metal and wire from raw material. The company has developed a method whereby high-grade filament wire can be produced commercially.

The Bonnell Manufacturing Company, Cleveland, O., has prepared a "Reference Book" containing illustrations of all types of "Adaptiboxes" and covers for same that it manufactures; listing a variety of receptacles, wall sockets and five and ten-ampere single and double-pole service snap switches that can be used in connection with these fittings.

The Waverley Company, Indianapolis, Ind., directly after supplying an order for 20 of its electric delivery wagons to the Fleischmann Yeast Company, New York City, has received an order for 10 of the same type from Mandel Brothers' large department store in Chicago. The quiet and easy running qualities of these shaft-driven vehicles were important points in securing these orders.

The Hess-Bright Manufacturing Company, Philadelphia, Pa., has issued a 32-page bulletin relative to its ball bearings for use in woodworking machinery. This publication is very excellently illustrated and describes not merely the types of ball bearings suitable for this class of machinery, but explains how these may readily be applied to various machines and the very satisfactory results thereby attained.

The Crocker-Wheeler Company, Ampere, N. J., states that the growth of its business on the Pacific Coast has been so rapid that it has found it necessary to transfer J. E. Fries to the San Francisco office as its Pacific Coast engineer. With the reorganization of this office prompter service will be possible than heretofore to all current inquiries. On April 1 the company also opened an office in the Title Insurance Building, Los Angeles, Cal.

James Beggs & Company, 36 Warren Street, New York City, have issued a fourth and revised edition of the book "Feed Water Filtration." This book deals with the removal of organic matter, oil, grease and other floating particles from boiler water and illustrates and describes numerous installations of the Blackburn-Smith feed-water filter and grease extractor. A copy will be sent by the company to anyone interested.

The Steam Appliance Company, 304 West Randolph Street, Chicago, Ill., has issued a bulletin descriptive of the Gebhardt steam meter. This is a simple, accurate and convenient instrument for indicating the flow of steam through pipes of all diameters and at all working conditions of temperature and pressure. It shows directly the pressure in the line, the velocity of the steam and the amount discharged in pounds per hour. The instrument is free from moving parts and is carefully calibrated.

The Uehling Instrument Company, Passaic, N. J., has issued a 33-page booklet entitled "Combustion and the Cost of Power." It contains a considerable amount of information on boiler efficiency and how it may be increased by the use of CO^2 meters. The meters are described in Bulletin 103, which has just been issued by the company. Six styles of meters are illustrated and described. On the last page is a brief summary telling why measurements of temperature and of carbonic acid gas increase boiler efficiency.

The Simplex Electrical Company, Chicago, has prepared a new catalog dealing with steel-taped cables. This cable is intended as a safe and reliable substitute for underground conductors and ducts where a duct system is not justified because of its expense, or where local conditions make it undesirable or impracticable. The catalog describes the construction of this cable, offers suggestions for its installation and gives comparative costs between Simplex steel-taped and other cables.

The George Cutter Company, South Bend, Ind., has issued catalog No. 11, which is a 120-page book devoted to the numerous electric-light specialties developed in the company's 23 years' experience in the making and perfecting of devices for insulating and supporting outdoor lamps. Among the specialties listed and illustrated are: pulleys, hangers, insulators, pole fittings, brackets, arms, arc hoods, pole-tops, outriggers, mast arms, street crooks, ornamental cluster posts, special decorative newels and brackets, incandescent hoods, brackets and fixtures, etc. Each of these devices is supplied in a great variety of types to suit all conditions and requirements.

Bell Electric Motor Company, Garwood, N. J., is distributing a catalog illustrating and describing its single-phase motors. These machines are made of various types for numerous classes of service and are all equipped with the Bell short-circuiting device, which permits of automatic starting.

The United States Light & Heating Company, Niagara Falls, N. Y., reports that increased business will necessitate an enlargement of its present plant, which was completed only last May. A new starting and lighting device for motor cars recently patented by the Company accounts for part of the increased business. During one week the orders for equipment of 35,000 motor cars with this device were received.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued a number of descriptive leaflets relating principally to its various lines of motors. Leaflet No. 2303 describes direct-current crane motors. Leaflets 2313, 2314 and 2315 are devoted to commutating-pole mine motors Leaflets 2376 and 2377 describe box-frame interpole railway motors for lo-

comotives and for 600-1,200-volt service. Leaflet 2368 treats of strap-wound armature coils for railway motors. No. 2370 covers various details of railway motors, such as bearings, brush holders, commutators, etc. No. 2464 describes type H D rheostats for direct-current motors. Leaflet No. 2393 is devoted to the Westinghouse dynamotor-compressor set for use on 1,200 and 1,500-volt direct-current railways. Leaflet 2444 describes equalizer flywheel hoist sets.

Record of Electrical Patents.

Issued by the United States Patent Office, May 14, 1912.

1,025,990. Cash Register. W. H. Muzzy, assignor to National Cash Register Co., Dayton, O. Includes clock-controlled electrical means for operating the recording mechanism.

1,025,992. Transmitter for Telephonic or Audiphonic Systems. H. G. Fape, Buffalo, N. Y. Has means for directing sound waves circumferentially about the sound box and central electrode against the diaphragm.

1,025,998. Diaphragm Horn or Alarm. S. Rosofsky, Brooklyn, N. Y. An electric motor operates a vibrator wheel.

1,026,003. Circuit-Opening and Closing Switch for Charging Circuits. A. J. Stecker, Detroit, Mich. An electro-

1,026,238.—Plug Connector.

magnetic switch for governing a storage-battery charge.

1,026,008. Clock Mechanism for Signals. F. O. Warner, Baltimore, Md. An electric clock system with a master and secondary clocks.

1,026,019. Projecting Lantern. R. Bright, Jr., Aberdeen, Scotland, and J. M. W. Wright, Sunderland, England. Electromagnetic clutches govern the movement of the screens.

1,026,029. Selective Electrical Signaling System. C. L. Goodrum, assignor to P. C. Burns, Chicago, Ill. A telephone system with ringing generator and keys, grounded batteries for supplying plus and minus currents to the relays, and local calling devices.

1,026,041. Engine Stop. J. L. Kimball, assignor to Locke Regulator Co., Salem, Mass Electrical control for the valves.

1,026,054. Magneto. A. Schmidt, assignor to Champion Ignition Co., Flint, Mich. Has a special distributing mechanism

1,026,057. Microphone. H. E. Shreeve, assignor to Western Electric Co., New York, N. Y. Relates to the construction of the electrode and carbon chamber.

1,026,062. Oscillating Motor-Driven Fan. C. C. Waite, assignor to Shedd Electric Co., Roselle Park, N. J. A gear-driven oscillating mechanism.

1,026,077. Dual Ignition System. C. Cuno, assignor to Connecticut Telephone & Electric Co., Meriden, Conn. A combined magneto and storage-battery system.

1,026,118. Hoisting Apparatus. C. O Pearson, New York, N. Y. Includes a pair of electric motors, means for independently driving a pair of traction sheaves, and brakes for the motors and for the sheaves.

1,026,126. Advertisement-Displaying Apparatus. J. T. Roffy, assignor to Nernst Lamp Co. An electric sign projector.

1,026,150. Electric-Wave Transmission. J. H. Cuntz, Hoboken, N. J. Includes an electric cable with the conductors helically wound around an iron-wire core to counterbalance the capacity by inductance.

1,026,151. Service-Meter Circuits. H. D. Currier, and G. Wolf, assignors to Western Electric Co., Chicago, Ill. An electromagnetically operated telephone meter.

1,026,160. Indicating Ringing Key. W. E. Harkness, assignor to Western Electric Co. A key for telephone party lines.

1,026,164. Switch or Junction Box. O. C. Hoffmann, assignor to R. Hatch, Buffalo, N. Y. Has brackets adjustably held thereon, and retainer wedges co-acting with the brackets to hold them in adjusted position.

1,026,183. Circuit-Controlling Key. H. E. Shreeve, assignor to Western Electric Co. A telephone-switchboard key.

1,026,196. Watchcase Receiver. W. O. Beck, assignor to Western Electric Co. A head receiver for a telephone operator.

1,026,197. Metallurgical Furnace. G. H. Benjamin, New York, N. Y. Some of the chambers are gas heated and others electrically heated.

1,026,199. Revertible-Call-Indicating Means for Telephone-Exchange Systems. A. M. Bullard, deceased, by M. K. Bullard, administratrix, assignor to Western Electric Co. An automatic means for determining which party on a party line has called.

1,026,200. Railway Block-Signaling System. Y. Burgess, assignor to International Automatic Signal Co., Kansas City, Mo. Includes track circuits and relays governing a cab signaling system.

1,026,217. Electric Water-Heating Device. H. Löfquist, Stockholm, Sweden. Has a number of connected casings with resistance wire wound on radial cores.

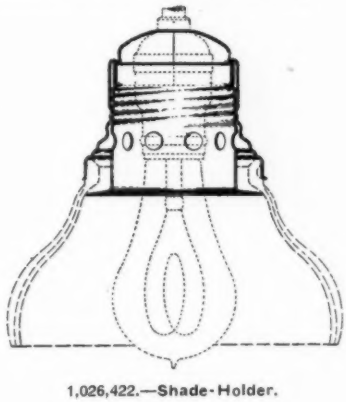
1,026,231. Audiphone Transmitter. C. Williams, Chicago, Ill. Has a pair of electrodes, one of which is the diaphragm.

1,026,238. Electrical Connection. J. M. Anderson, assignor to Albert & J. M. Anderson Manufacturing Co., Boston, Mass. A plug receptacle has special means for relieving the strain and chafing from the conductors.

1,026,243. Type-Setting Device. H. Drewell, assignor to Schnellsetz-Maschinengesellschaft M. B. H., Berlin, Germany. Includes automatic control for the operating electromagnets.

1,026,260. Telephone Bracket. E. P. Guthrie, Oklahoma, Okla. An adjustable support carries a spring keeper to hold the telephone.

1,026,269. Attachment Plug. G. C. Knauff, Chicago, Ill. The insulating body is made of material that expands and softens when heated and again contracts and hardens on cooling.



1,026,422.—Shade-Holder.

1,026,281. Electric Refining Crucible. J. H. Reid, assignor to Patents Purchasing Co., Appleton, Wis. Is formed of material possessing conductivity only when heated and having means for reducing the conductivity of the crucible as the operation proceeds.

1,026,290. Alternating-Current Program System. J. L. Wrenn, Washington, D. C. A master clock intermittently closes a relay circuit including a step-down transformer and translating devices.

1,026,296. Auxiliary Carbon-Contact Circuit-Breaker. C. C. Badeau, assignor to S. B. Condit, Jr., Boston, Mass. The secondary contacts are made of flat carbon disks presenting a fresh arcing surface each time.

1,026,297. Phototelegraphy. T. T. Baker, Cricklewood, England. Line current is interrupted for different periods corresponding to light and shady parts of the picture transmitted. Sensitive paper at the receiving station is correspondingly affected.

1,026,328. Telephone System. F. R. Parker, Chicago, Ill. Relates to the lamp-signaling circuits.

1,026,329. Flashlight Apparatus. J. A. Smith, Chicago, Ill. Includes electrical means for igniting the flash powder.

1,026,334. Cooking Apparatus. R. B. Vessey, Flint, Mich. Has thermostat-

ically controlled electric heaters in a chamber of the "fireless-cooker" type.

1,026,343. Manufacture of Refractory Conductors. W. D. Coolidge, assignor to General Electric Co. Powdered tungsten is rubbed into a cadmium-mercury alloy, shaped into a wire and the other metals removed.

1,026,344. Binder for the Manufacture of Refractory Conductors. W. D. Coolidge, assignor to General Electric Co. Comprises powdered tungsten bound together by an alloy containing cadmium, lead and mercury.

1,026,345. Apparatus for Treating Filaments. W. D. Coolidge, assignor to General Electric Co. In an exhausted container is a reel of ductile wire, portions of which are successively shaped and then treated by current.

1,026,360. Arc-Lamp Hanger and Automatic Cutout. A. G. Munson and M. N. Webster, St. Paul, Minn. Movement of the chain up and down controls contacts in the hooded hanger.

1,026,363. Electrically Heated Tool. L. F. Parkhurst, assignor to General Electric Co. A treeing iron with the heating element inside a steel tube whose ends form the handles.

1,026,364. System of Control. K. A. Pauly, assignor to General Electric Co. Includes an induction and a direct-current motor whose speeds are maintained proportional.

1,026,377. Resistance Unit. L. E. Barringer, assignor to General Electric Co. Comprises a porcelain tube having a metal tube enameled to the inner surface and a resistance conductor enameled to the outer surface.

1,026,380. Insulated Platform. G. L. Brooks, Seattle, Wash. A platform supported by insulating brackets from the cross-arm so as to be entirely insulated from the pole.

1,026,382 to 1,026,384. Metal Filament. W. D. Coolidge, assignor to General Electric Co. The first patent describes a pliant tungsten-filament wire prepared from a mixture of powdered tungsten and cadmium-bismuth alloy. In the second the binder is cadmium amalgam. The third patent describes the method of heating to drive off the other metals and leave a pure tungsten filament.

1,026,388. Mast for Wireless Telegraphy. O. Fricke, New York, N. Y. Comprises a foundation mast and a counterbalanced auxiliary or pendulum mast supported on the apex of the main mast.

1,026,391. Voltage Transformation. M. R. Hanna, assignor to General Electric Co. A high-tension direct-current railway system provides two motor-generator sets on each train.

1,026,392. Incandescent-Lamp Filament. C. A. Hansen, assignor to General Electric Co. The squirting mixture consists of a powdered refractory material and a metal-oxalate binder.

1,026,393. Burglar and Fire Alarm. J. Hartley, Philadelphia, Pa. The circuit contacts are closed either by movement of the door or by melting a soldered connection.

1,026,415. Automatic Steering Device for Flying Machines. R. M. Thompson, Tacoma, Wash. The steering means are electrically controlled in accordance with movement of the magnetic needle.

1,026,422. Shade-Holder for Electric Fixtures or Electroliers. L. W. Anderson, assignor to Plume & Atwood Manufacturing Co., Waterbury, Conn. Includes an inner tubular support into the top of which two dome sections are secured and an outer locking sleeve.

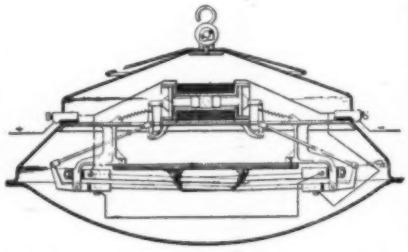
1,026,428. Tungsten Purification. W. D. Coolidge, assignor to General Electric Co. In filament manufacture the iron is removed by firing in a vacuum below the fusing point of tungsten.

1,026,429. Refractory Conductor. W. D. Coolidge, assignor to General Electric Co. The process consists in compressing a refractory powder into a rigid body, impregnating this with ductile metal, and subsequently passing current through the body to vaporize ductile metal and consolidate the body.

1,026,464. Method of Electrically Charging Electrostatic Separating Devices. F. O. Schnelle, Frankfort-on-the-Main, Germany. The electrodes are charged from a transformer and rotated synchronously with the supply source.

1,026,518. Electric Alarm. W. J. Knobloch, Washington, D. C. A ball float closes a buzzer circuit.

1,026,527. Process to Regenerate and Improve the Structure of Lead Electrodes of Secondary Batteries. E. H. Naylor, London, Eng. Consists in treating the plates with sulphothionyl chloride, heating them, treating with acid, washing and finally forming.



1,026,569.—Horizontal-Carbon Flaming-Arc Lamp.

1,026,531. Advertising Display Sign. C. F. Spery, assignor to American Art Works, Coshocton, O. An electric motor moves the target in opposite directions at definite intervals.

1,026,552. Locomotive. A. F. Batchelder, assignor to General Electric Co. A four-truck electric locomotive in which the motors are mounted on the inner trucks.

1,026,564. Electric Water-Heating Syringe. H. M. Crawford, Lima, O. Has a heating coil arranged in the hose whose circuit is closed at the same time as the valve is operated.

1,026,565. Combined Ignition System. R. H. Cunningham, New York, N. Y. Includes a magneto and battery.

1,026,568 and 1,026,569. Electric Arc Lamp. K. v. Dreger, assignor to Gesellschaft für Verwertung Technischer Patente M. B. H., Bremen, Germany. A flaming arc lamp with one or two pairs of horizontal carbons, one carbon of each pair being superposed over the other.

1,026,586. Apparatus for Automatically Opening and Closing Cocks, Valves, Switches, and the Like. W. Howlin, Newtown, New South Wales, Australia. A clock-controlled rotatable controller.

1,026,596. Stand for Electric Heaters and Irons. R. P. Moodie and C. W. Ball, Ottawa, Ont., Canada. A reversible stand to permit holding a flatiron in upright or inverted position.

1,026,611. Electrically Heated Syringe. M. H. Shoenberg, assignor to Presto Electrical Manufacturing Co., San Francisco, Cal. The heating element is spirally arranged in the tube between the nozzle and bulb.

1,026,627. Electrodeposition of Metals. A. Leuchter, New York, N. Y. A process for simultaneously depositing iron and nickel.

1,026,628. Electroplating. A. Leuchter, New York, N. Y. The anode contains nickel and manganese alloy and the electrolyte contains salts of the two metals.

Reissue.

13,420. Electrode for Reversible Galvanic Batteries. W. Morrison, Des Moines, Ia. Original No. 975,981, dated Nov. 15, 1910. An alkaline battery whose electrodes comprise zinc-chromium compound in porous tubes.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired May 21, 1912:

539,404. Regulating Alternating-Current Induction Motors. A. H. Armstrong, Schenectady, N. Y.

539,418. Conduit System for Electric Railways. W. H. Cotton, St. Louis, Mo.

539,421. Signaling Apparatus. R. O. Crowley, Elizabeth, N. J.

539,431. Electric Bell. F. G. Ingersoll, New York, N. Y.

539,446. System of Electrical Distribution. E. W. Rice, Swampscott, Mass.

539,450. System of Electrical Distribution. C. P. Steinmetz, Schenectady.

539,452. Electric Meter. C. P. Steinmetz, Schenectady, N. Y.

539,454. Carbon Brush. E. Thomson, Swampscott, Mass.

539,500. Automatic Time Switch for Storage Batteries. W. Biddle, Brooklyn, N. Y.

539,501. Electrical Instrument for Medical Purposes. B. Y. Boyd, Wichita, Kans.

539,511. Signal-Box Attachment. A. Gruner, San Francisco, Cal.

539,512. Telegraph Relay. A. Gruner, San Francisco, Cal.

539,529. Electric Railway Signal. H. V. Miller, Bloomington, and A. C. Miller, Aurora, Ill.

539,583. Electric Cutout. J. R. Hersh, Denver, Colo.

539,585. Rheostat Face Plate with Supplemental Rheostat. F. Kraemer and M. Kruger, Chicago, Ill.

539,616. Electrical Bond Clamp. A. Green, Rochester, N. Y.

539,622. Cutout for Arc Lamps. P. Kirkegaard, Brooklyn, N. Y.

539,701. Multiple Signal Transmitter. B. J. Noyes, Boston, Mass.

539,712. Telephone Call. F. J. Troll, Washington, D. C.

539,725. Cutout Block. F. A. Chapman, Philadelphia, Pa.

539,726. System of Controllers for Electric Motor Cars. C. L. Coombs, Washington, D. C.

539,737. Electric Treasure Guard. R. A. Habersham, Portland, Ore.

539,778. Rheostat Switch for Electric Motors. F. B. Rae, Detroit, Mich.